NATIONAL AERONAUTICS AND SPACE ACT

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HEARINGS

BEFORE THE

SPECIAL COMMITTEE
ON SPACE AND ASTRONAUTICS
UNITED STATES SENATE

EIGHTY-FIFTH CONGRESS

SECOND SESSION

ON

S. 3609

A BILL TO PROVIDE FOR RESEARCH INTO PROBLEMS OF FLIGHT WITHIN AND OUTSIDE THE EARTH'S ATMOSPHERE, AND FOR OTHER PURPOSES

MAY 13, 14, AND 15, 1958

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NATIONAL AERONAUTICS AND SPACE ACT OF 1958

TUESDAY, MAY 13, 1958

UNITED STATES SENATE,
SPECIAL COMMITTEE ON SPACE AND ASTRONAUTICS,
Washington, D. C.

The special committee reconvened, pursuant to recess, at 10:05 a. m., in the caucus room, Senate Office Building, Senator Lyndon B. Johnson (chairman) presiding.

Present: Senators Johnson (chairman), Green, McClellan, Saltonstall, Mundt, Anderson, Symington, and Bricker.

Also present: Edwin L. Weisl, consulting counsel; Cyrus Vance, consulting counsel; Eilene Galloway, special consultant; Dr. Glen P. Wilson, technical coordinator; Gerald W. Siegel, Stuart French, and Solis Horwitz, professional staffmembers.

Senator JOHNSON. The committee will come to order.

Our first witness this morning is Dr. Hugh L. Dryden, Director, National Advisory Committee for Aeronautics.

Dr. Dryden, the committee has considerable interest in your testimony, and we extend you a hearty welcome this morning.

As a background to what you are about to say, I am going to ask consent to insert at this point in the record a biography, setting forth your history and qualifications.

(The biography referred to is as follows:)

BIOGRAPHY OF DR. HUGH L. DRYDEN, DIRECTOR, NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

Dr. Dryden was born on July 2, 1898, at Pocomoke City, Md.

He attended Johns Hopkins University where he received his bachelor of arts degree in 1916, master of arts in 1918, and his doctor of philosophy in 1919. He also has received several honorary degrees.

He was employed by the National Bureau of Standards from 1918 to 1946. He was the Director of Aeronautical Research in the NACA from 1947 to 1950, and has been Director of the NACA since 1950.

He has been editor of the Journal of the Aeronautical Sciences; honorary fellow, Institute of Aeronautical Sciences (president in 1943); Wright Brothers lecturer, Institute of Aeronautical Sciences, 1938; honorary officer, Order of the British Empire; home secretary of the National Academy of Sciences; president, 1952–56, International Union of Theoretical and Applied Mechanics; fellow, American Physical Society.

He has published—with H. Bateman and F. D. Murnaghan—Hydrodynamics, 1932; Aerodynamic Theory, volume VI, division T, 1936; Fluid Mechanics and Statistical Methods in Engineering—with others, 1941.

Senator JOHNSON. I understand that you have a prepared statement, Dr. Dryden, and the committee will appreciate it if you will proceed in your own way.

STATEMENT OF DR. HUGH L. DRYDEN, DIRECTOR, NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS; ACCOMPANIED BY PAUL G. DEMBLING, GENERAL COUNSEL, NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

Dr. DRYDEN. Thank you. Mr. Chairman and members of the committee and counsel, less than 72 hours ago, I was high above the Atlantic Ocean, returning from a busy week in Europe.

As we flew westward, my thoughts ranged far beyond the comfort of the pressurized cabin, and, because they may be pertinent to the matters being considered by your committee, I should like to mention two of the subjects that came to mind.

My airplane was traveling at an airspeed of more than 300 miles per hour. The earth—some 20,000 feet below—was revolving at about 1,000 miles per hour.

Simultaneously, the earth was traveling in space, in orbit around the sun, at the rate of about 66,000 miles per hour. At the same time, the sun itself was moving at the rate of 630,000 miles per hour, within our galaxy that we call the Milky Way.

The star nearest our Sun is Alpha Centauri. It is more than 25 trillion miles away.

We have to reach about 25,000 miles per hour to escape from the earth. To travel outside the solar system, we will have to escape from the gravitational pull of the sun. That will require a minimum speed of about 70,000 miles per hour. A space craft journey from the Earth to Alpha Centauri would take over 40,000 years at this speed.

As those increasingly large numbers flashed through my mind, I was reminded how enormous is the task ahead: of learning more about our solar system and the myriad galaxies which comprise the cosmos.

At the same time, I was impressed with the need for urgency to get on with the job, to use the new tools that we have just fashioned that, for the first time in history, enable us to probe the secrets of the universe, to see things as they really are, and to begin man's exploration of space.

The second of my thoughts on my homeward flight was based upon happenings of the previous week.

Everywhere I went, especially in Madrid and in Munich, where there were opportunities for conversation with others of the scientific community, I had been met with the following questions:

Was the United States really going to provide world leadership in the scientific, peaceful use of our new-found ability to send space craft far beyond the atmospheric envelope that encircles the earth?

Would the United States be willing to spend the hundreds of millions annually necessary to accomplish such explorations into space, even if the military advantages were not clearly foreseen and there was no demonstrated prospect of new scientific information that could be immediately translated into dollar-producing projects?

Fortunately, I was prepared for such questioning.

I could and did note that our national leaders in the administration and in both Houses of Congress had been virtually unanimous in declaring that the United States should promptly blueprint a wisely bold national space program, and that it should be directed toward exploration and exploitation of space for peaceful purposes. I told

my questioners how the leaders of both the House and the Senate had taken on the task, in addition to their already burdensome duties, of studying intensively the ways and means to insure that those intentions should become actualities.

As I flew westward I could not help but think how important it will be that as a nation we carry forward these plans for the peaceful use of our new ability to move into space.

I realized, of course—and I believe this point of view is shared by even the most anxious of my European friends—that the United States will have to be alert to every possibility of using the new space technology to strengthen our military powers of deterrence. But the important, the vital point, is that we need to put our national emphasis upon the civil aspects of space technology.

The simple fact is, in addition to being a peaceful Nation composed of citizens who hate the thought of war, we must so conduct ourselves that our friends around the world—and our enemies as well—will know beyond mistake that, although we are amply strong as our national interest requires, we are striving by word and deed for peace.

Last week, Dr. James H. Doolittle, Chairman of the National Advisory Committee for Aeronautics, appeared before your committee. Since my return, I have read his statement and—except for his comments about me—I concur completely.

I have also reviewed, hurriedly I must admit, the comments of the other gentlemen who testified last week before your committee.

In the light of that previous testimony and keeping in mind some of the questions which you gentlemen have asked, I should like now to make several comments that may be helpful and then attempt to provide answers to such further questions as you may have.

First, may I say I believe that the administration is far more interested in the accomplishment of a national space program that—except for the space technology efforts of the Military Establishment—will be under civil direction, than it is in the precise language of any part of Senate bill 3609.

In the early stages, when the administration was studying how best to formulate its national space program, the NACA made recommendations.

As I understand it, the bill was purposely written in general, rather than specific, terms because the entire subject of space technology is—and for some time to come will remain—largely an assortment of unknowns. Today, we simply do not know what we will find, or what good it will be, when we venture into space.

There is a distinction between the situation today respecting space legislation and the situation at the end of World War II when the Atomic Energy Act was drafted.

In that earlier undertaking, the fearful possibilities of atomic energy for military purposes had already been demonstrated. The possibilities of civilian use of atomic energy were at least partially known.

In other words, in 1946 the atomic energy prospects—what needed to be done respecting both civilian and military research and development, and the necessary precautions that had to be taken—were sufficiently clear to make desirable the drafting of legislation in very specific and detailed form.

The success of that congressional effort is apparent from the manner in which, for more than 10 years, the act has stood the test of time.

The Atomic Energy Act dealt with problems that were, relatively at least, finite.

The problems of the new era of space are more nearly infinite; at the very most, they are largely unknown today. That is why, to the best of my knowledge, the language of the bill was written so flexibly: to permit formulation and prosecution of a wise and vigorous national space program without the necessity of early, major revision of the bill, perhaps on an annual basis.

One of the most difficult problems in the drafting of the legislation for space is how to spell out which of our country's space activities shall be under civilian control and which shall be the responsibility of the Department of Defense.

My reading of the earlier testimony before your committee brings an awareness of a problem that I, who am not greatly experienced in legislative matters, had not anticipated from my reading of the bill.

On page 2, beginning on line 4, the bill states, and I quote:

> The Congress further declares that such activities should be directed by a civilian agency exercising control over aeronautical and space research sponsored by the United States, except insofar as such activities may be peculiar to or primarily associated with military systems or military operations, in which case the agency may act in cooperation with, or on behalf of, the Department of Defense.

Now, I find that this language has been interpreted as meaning, on the one hand, that the role of the National Aeronautics and Space Agency could be reduced to the point of becoming inconsequential; and, on the other, that the Department of Defense could be unduly limited in the development of space technology for military purposes.

I believe that the Director of the Budget, Mr. Maurice Stans, will, in his testimony before your committee later today, make a specific suggestion for a change in wording to clarify the intent of this provision.

Over the 43 years of its existence, the NACA has managed to work closely and well with the military services, without being dominated or absorbed by them. Historically the armed services have been first to make use of the aeronautical advances that the researches of the NACA scientists and engineers have made possible. However, the commercial side of aviation has not been overlooked and also has made consistent use of these aeronautical advances, some years after the military services.

In the case of space technology, it is my opinion that the requirements of the scientists for data-gathering projects may in many instances be more clearly known than those of the military services. In other words, it may well be that the advances we make in our capability to move instruments—and men—farther into space, for the accomplishment of scientific missions will prove to be militarily useful.

There has been considerable discussion about the composition of the National Aeronautics and Space Board, and about the fact that, as the bill is presently drafted, the Board will be advisory, rather than governing. It is my understanding that there were two reasons why the administration preferred that authority for operation of our

national space program be in the hands of a single man, the director of NASA, appointed by the President with the advice and consent of the Senate. These two reasons are: (1) To provide for quicker, more direct action on the space program and (2) to insure that one man could be held fully responsible if the program wasn't going the way it should.

The organic legislation of the NACA stipulates that the composition of the main committee shall consist of two representatives each from the Air Force, Navy, and the Civil Aeronautics Authority, and one each from the Smithsonian Institution, the United States Weather Bureau, the National Bureau of Standards, and the Department of Defense. In addition, and I quote:

> not more than seven other members selected from persons acquainted with the needs of aeronautical science, either civil or military, or skilled in aeronautical engineering or its allied sciences.

More than a year ago, legislation was introduced, to raise the committee membership to 19, including 2 from the Army.

Senate bill 3609 calls for appointment by the President to the Space Board of not more than 8 members from Government, with a total membership not to exceed 17. The only stipulation, concerning Government members of the Board, is that at least one shall be from the Department of Defense. Here again, it is my belief that the language was purposely flexible, to permit changes in the Government representation in the Nation's civilian space effort when it becomes clearer and more mature. I expect, however, that the Army, Navy, and Air Force will be represented on the Board, as well as the Department of Defense. Similarly, I expect that the Atomic Energy Commission will be represented, because atomic energy almost certainly will be used importantly to power vehicles for space exploration in the years to come. The National Science Foundation will need to be represented, and probably the United States Weather Bureau, because of the importance of weather observation from satellite stations. That accounts for all but 1 of the 8 Government members. It will be very difficult to provide membership for every Government agency that has interest in space matters without enlarging the Board.

There is one further point I should like to discuss. The bill has made no specific mention of the very important role of the Atomic Energy Commission in the development of nuclear power for space exploration in the years to come. Under the Atomic Energy Act, the Atomic Energy Commission has developed nuclear power for submarines, ships and electro power generating stations. The submarine, ship, and power station have been the responsibility of the agencies working in close cooperation with the AEC. The AEC is now working on nuclear power for aircraft and of interest for space rockets. The new space agency would be expected to develop space craft using nuclear power as rapidly as the AEC develops the nuclear components, and the relationship between the two agencies will have to be very close. I have personally recommended increased effort by the AEC in the nuclear rocket-program.

To implement the policy declaration, contained in section 2, objective 6, starting page 2, line 22, of Senate bill 3609, which reads—

> cooperation by the United States with other nations and groups of nations in work done pursuant to this act and in the peaceful application of the results thereof—

the following language is suggested for insertion in the bill:

INTERNATIONAL COOPERATION

The agency may, under foreign policy guidance by the Department of State, engage in a program of international cooperation in work done pursuant to this act, and in the peaceful application of the results thereof, pursuant to agreements negotiated by the Department of State or approved by that Department.

This language has been worked out with the Department of State, and has the approval of that Department and the Bureau of the Budget.

In closing, I should like to quote three sentences from Dr. Doolittle's statement of May 6:

I have the conviction, and in this I find myself in the company of some very wise men, that a century from now, perhaps much sooner, people will say that this venturing into space that we're planning now was one of the most practical, intelligent investments of our national wealth to be found in history. If we, in the United States, take the wisely bold action necessary to lead in exploiting the possibilities of space technology for science, all mankind will benefit. If Russia wins dominance in this completely new area; well, I think the consequences are fairly plain—probable Soviet world domination.

Here, in a very few words, is the reason why we must do what is necessary to lead in space technology.

That completes my opening statement, Mr. Chairman, and I'll be very happy to try to answer questions.

PARTICIPANTS IN DRAFTING OF BILL

Senator JOHNSON. Thank you, Dr. Dryden. I certainly commend you for reiterating Dr. Doolittle's statement. I have long felt, as he does, the very great importance of the United States taking bold action in this field. It is unfortunate that we should have hit-or-miss legislation before us that has to be doctored up each time a new witness testifies.

Let me ask you this question. Who participated in drawing up these original instructions which were given to the lawyers who drafted this bill?

Dr. DRYDEN. The bill was drafted by a committee working in the Budget Bureau. Mr. Dembling, sitting beside me, was a member of that committee representing the National Advisory Committee for Aeronautics.

Senator JOHNSON. Would you identify him for the record?

Dr. DRYDEN. Mr. Paul G. Dembling, who is Legal Adviser of the NACA.

Senator JOHNSON. Do you know who participated in drawing up the instructions that were given to the lawyers?

Dr. DRYDEN. I do not know how to answer that question. I gave certain instructions and suggestions to Mr. Dembling, representing the point of view of people within the NACA, but I do not know how to answer the other question.

Senator JOHNSON. To what extent did your counsel participate in the drafting of the legislation?

Dr. DRYDEN. He was a member of the committee who sat with them, I believe during the entire process.

Senator JOHNSON. How many members were there of that committee?

Dr. DRYDEN. I think five.

Senator JOHNSON. Would you give the names and titles for the record?

Dr. DRYDEN. I think Mr. Stans can give the names. I don't know that I know exactly who they all were.

Senator JOHNSON. Would Mr. Dembling know with whom he associated?

Dr. DRYDEN. I think so.

Mr. DEMBLING. Mr. Finan, Assistant Director of the Bureau of the Budget.

Senator JOHNSON. How do you spell that?

Mr. DEMBLING. F-i-n-a-n.

Mr. Alan Dean, Mr. Finan's assistant, and Mr. Kenneth McClure, who was on detail to the Bureau of the Budget and is Assistant General Counsel for the Department of Commerce.

Mr. S. Paul Johnston, who is director of the Institute of Aeronautical Sciences, sat in at various times. That comprised most of the working committee, sir.

Dr. DRYDEN. Mr. Johnston was serving temporarily as a member of Dr. Killian's staff.

TIME TO STUDY BILL

Senator JOHNSON. How much time did you have to study the draft bill which was sent to Congress on April 2, Doctor?

Dr. DRYDEN. It is fair to say we were in complete touch with the state of the draft at all times though Mr. Dembling's membership on the committee.

Senator JOHNSON. Do you mind answering my question? How much time did you have to study the draft bill? It came to us on April 2. When did you start studying it? When did you see it in its completed form?

Dr. DRYDEN. In its completed form, approximately a week beforehand, sir, in the final form.

Senator JOHNSON. Did you have anything to do with setting the 24-hour limit on the Defense Department?

Dr. DRYDEN. No, sir.

Senator JOHNSON. Do you know why they should have been limited to 24 hours?

Dr. DRYDEN. No, sir. This is a part of the operation of Mr. Stans' office. I'm not familiar with that.

SPACE ACT NEEDED THIS SESSION

Senator JOHNSON. You stated, I believe, to the House committee that it is important to get a bill on outer space passed by Congress this session, did you not?

Dr. DRYDEN. Yes, sir.

Senator JOHNSON. And would you specifically list for the record your reasons for this viewpoint?

Dr. DRYDEN. The primary reason is some degree of uncertainty which exists in the people who are working on space projects and who I think will be the same people who will continue to work on space projects, as to whether there will be any change in the management at the top, which might interfere with the progress of the program. I

think it is important to settle the question of responsibility promptly. This is the only reason, sir.

INTERNATIONAL COOPERATION

Senator JOHNSON. Did you give any consideration to the international cooperation aspect of the legislation before it came to us?

Dr. DRYDEN. Yes, sir.

Senator JOHNSON. Why was it not included in the original bill?

Dr. DRYDEN. The State Department felt that this was unnecessary; that the President had the plenary powers to direct participation in international matters.

Senator JOHNSON. Have they reversed their position?

Dr. DRYDEN. They have agreed to the language which I read to you.

Senator JOHNSON. Does that represent a change in their position, then? Can you answer that more directly?

Dr. DRYDEN. Only insofar as being agreeable to inserting this in the bill. In their opinion, I think, it simply represents a restatement of the authority already existent in general law.

Senator JOHNSON. Why do you think it is necessary to put it in the bill?

Dr. DRYDEN. I think, myself, that, in order to emphasize the desire in setting up the new Agency to work for peaceful purposes and to join with others in the world in this direction, it is better to have something specific in the bill other than the mere clause in the introductory preamble.

Senator JOHNSON. Do you think, if you had had more time in drafting it, you might have included this originally?

Dr. DRYDEN. It was included in the draft that we sent over originally.

Senator JOHNSON. It was eliminated, and now is being reincluded?

Dr. DRYDEN. That is right.

OTHER AMENDMENTS

Senator JOHNSON. Are you aware of any amendments or any changes that the Defense Department intends to propose to the bill as now written?

Dr. DRYDEN. I think Mr. Stans has worked out with the Defense Department changes in the language which meet the desires of the Defense Department. I do not know the specific details of the change. But I was told last evening that Mr. Stans will present such a proposal to the committee.

Senator JOHNSON. Have you been consulted about the changes?

Dr. DRYDEN. In general, they were to make it perfectly plain that the responsibility for military projects lies with the Defense Department. I understand that some people have read the language in the bill to mean that the civil Agency would control the military projects within the Department of Defense, and the change in language is to make it perfectly plain that the Defense Department will be responsible for military projects.

Senator JOHNSON. Have you read the changed language?

Dr. DRYDEN. I have not seen the exact language, sir.

Senator JOHNSON. Have you approved it without seeing it?

Dr. DRYDEN. I did not say that I approved it without seeing it.
Senator JOHNSON. Do you approve it?
Dr. DRYDEN. I cannot say that without seeing it.
Senator JOHNSON. Do you plan to see it before it is presented?
Dr. DRYDEN. Yes sir.

MILITARY AND CIVILIAN PROJECTS

Senator JOHNSON. Would you define for the committee your understanding of the concepts of civilian control and military control as used in the context of the national space policy?

Dr. DRYDEN. The language in the bill is, I think, interpreted to mean that the civil Agency will have such projects, will deal with such matters, as the scientific exploration of space, the measurements of the properties of the high upper atmosphere and the nearby space, projects which temporarily are now within the Department of Defense dealing with lunar problems, later on with Mars problems, and projects to put a telescope into space. I think the civilian Agency will be engaged in problems of putting man into space, of encouraging the developments which will lead to propulsions, which will make most important ambitious undertakings in space. I think, on the other hand, the military will be concerned with weapons systems, with reconnaissance satellites, and with matters of similar nature.

CHANGE FROM NACA TO NEW AGENCY

Senator JOHNSON. I observed in your statement that you made some comment on the likelihood of other Government agencies being represented on this Board. Now, do you think it is wise in converting the National Advisory Committee on Aeronautics to the National Space Agency, to propose a bill that would make the Board advisory when it has full directive power, as the Committee directing your present organization has?

Dr. DRYDEN. My original feeling, sir, was that the present organization, which has worked very well for 40 years, might very well be left unchanged. However, I have been convinced by the desire for a greater concentration of authority, for the necessity of setting up an organization in which the connections are very direct. This meant, of course, that the committee would then go to an advisory capacity, rather than an executive capacity.

Senator JOHNSON. Convinced by whom?

Dr. DRYDEN. Convinced by the discussions with the people in the administration and in the Budget Bureau.

Senator JOHNSON. What people?

Dr. DRYDEN. Well, with the Director of the Budget, with Dr. Killian, and with people of this character, that it was advisable because of the change in the nature of the activities in the new Agency. I should like to make very clear that it is my concept and understanding that the bill does not assign space duties to the NACA. It creates a new agency, which has new types of responsibilities, specifically, for development and for operation of space vehicles. This will require a part of the development of a new part of the Agency which is intended to operate very largely by contract operation rather than through Government laboratories, so that we have a different type of operation in which it is necessary to have a some-

what more direct and tighter control. This is the reason for the change in the setup.

Senator JOHNSON. You started out feeling that your present type of organization was the best method of handling it, but you were persuaded otherwise?

Dr. DRYDEN. That is correct, sir.

MEMBERSHIP ON NEW SPACE BOARD

Senator JOHNSON. Do you think the provisions in section 4 for representation on the Board are wisely drawn in requiring only one Government member, or do you think that we ought to spell it out in more detail?

Dr. DRYDEN. I did not read it as having only one Government member, sir.

Senator JOHNSON. It doesn't require more than one, does it?

Dr. DRYDEN. No more than eight. I think that may very well be made more specific. I did not read this as an intention, and in none of the discussions has there been any idea that there would be only one Government member.

Senator JOHNSON. You had the idea that a number of agencies would be represented, didn't you?

Dr. DRYDEN. Yes, and the bill provides that the present Board would become the first Board of the new Agency.

Senator JOHNSON. Do you have any objection to the language being as specific in the bill as you are in your testimony?

Dr. DRYDEN. None whatsoever.

Senator JOHNSON. Would you recommend that?

Dr. DRYDEN. I want to be sure of what I am recommending, sir.

Senator JOHNSON. Would you recommend spelling out in the bill the agencies to be represented on the Board as specifically as you spelled them out in your statement?

Dr. DRYDEN. I see no objection to it. I did not recommend it because, as I indicated in the statement, I think the desire was to permit the adjustment from time to time to meet changing needs.

Might I illustrate with the previous history of NACA? When we wish to add Army members, it is necessary to go through the legislative process of changing the Organic Act to change the membership. In its history, there has been frequent need for this. I see no objection to spelling it out in detail.

The only disadvantage I see is we may be back in a year or two to make some specific changes in the list.

Senator JOHNSON. Would you read that language and tell me where more than one Government member is required?

Dr. DRYDEN. I didn't say I thought that. I said in the discussion of this section I heard no ideas that would suggest that was contemplated.

Senator JOHNSON. Would you agree, then, that under the language only one is required?

Dr. DRYDEN. I think it could be read that way, sir.

Senator JOHNSON. I'm not sure I understand your answer.

Dr. DRYDEN. I say I think it could be read that way, yes, sir.

Senator JOHNSON. How do you read it?

Dr. DRYDEN. I read it as permitting a certain degree of flexibility and flexibility, of course, could be carried to the point of only one Government member, as you read it.

CONSULTATION WITH THE BOARD

Senator JOHNSON. Do you consider it desirable for the Director to have to consult the Advisory Board on purely administrative matters such as is indicated in paragraphs 3 and 4 of subsection 5 (c)?

Dr. DRYDEN. I think there is very great advantage to this. I might say I did suggest as a result of discussion with the chairman of the House committee, Mr. McCormack, that the words, "prior to" be omitted on page 5, section (c), and replaced by the word "on."

In other words, "prior to" does suggest that the director might be prevented from taking action by the necessity of consulting the boards prior to the steps.

I do want to bring out clearly what I think the functions of the Advisory Board are and the purpose of having such a Board. The members are not in the direct executive line, but we have found from long experience to have available for consultation on an advisory board the representatives of the agencies that we principally do businesss with—representation from the fields of science with which the agency is concerned—has a very great value.

I might illustrate the first point by a recent incident in which we had been asked by the Civil Aeronautics Administration for help in connection with regulations for new jet transports. They suggested that we borrow from the Air Force a tanker like the Boeing 707 to make some experiments.

General Le May was sitting in the committee for General White, and in 5 minutes, this transfer was arranged because we had on the Board for consultation people who had authority within the agencies with which we deal.

In a similar way, in dealing with scientific and technical matters, it has been very useful to have their advice. Our Board has met once per month, and we have found it very useful to have the advice of people who knew things going on within the field.

The second function of the Board—if they agree with the actions of the Director, their support has been most useful in dealing with the Budget Bureau and with the Congress, because members of the Board are unpaid, they are not full-time Government employees. If I appear before you as Director of the NACA, I am merely a Government man trying to build up the agency. If I have the support of the Advisory Board when I appear before you, this is very valuable.

A third important function of the Advisory Board is keeping in touch with the functions of the agency, of observing the agency, so that its operations are in a goldfish bowl among competent people. Such an Advisory Board protects the Congress and the President in maintaining a continual watch on the operations of the agency.

Senator JOHNSON. And you feel very strongly that an advisory board such as is proposed in this bill, in this very important field, is to be preferred to a board with full directive powers?

Dr. DRYDEN. I think so for this reason. We are writing the law for the future. As of the present time, the relationships of the Director of the NACA to the Board are very satisfactory on both sides. The

Board has delegated a great deal of power to the Director subject to postaudit. This has made it possible to take action, for example, on requests for cooperation with the services, and other matters, without waiting for a Board meeting, because the power is delegated. In the same way, the Board has restricted itself to general policy matters.

In the case of the budget, they have fixed the general budgetary policy. This arrangement has been very satisfactory, but I think we can see that there is a possibility when the field is changed to a field involving operations and procurement activities, that such a setup might be abused and cause trouble.

DETERMINATION OF SPACE POLICY AND DECISIONS ON PLACEMENT OF PROJECTS

Senator JOHNSON. Would you consider it desirable to give the proposed Space Board the power to establish national space policy and the power to determine where a particular project should be assigned for primary control purposes?

Dr. DRYDEN. I think, sir, that the national space policy will be set by Congress so far as the general policy is concerned. I can't conceive of so important a matter being handled at a lower level.

Now, within the administration, this is a matter for the organization of the executive department. I would defer to the opinion of the President and his advisers as to how space policy should be set up.

Senator JOHNSON. How would you differentiate between space weapons and space civilian matters?

Dr. DRYDEN. This is largely a matter of function and purpose. The weapon is something with which you fight a war and with which you cause damage. You provide information which will help you cause damage. Peaceful uses are: Weather observation, communications, the scientific measurements that you can take in space and so on. I agree that there will be questions of interpretation at the borderline, but I think in general the distinction is so clear that reasonable people can come to agreement.

Senator JOHNSON. How would you differentiate?

Dr. DRYDEN. A weapon is something with which you cause damage to other people, to impose your will by force. A peaceful use is one for scientific purposes, for commercial purposes, for communication.

Senator JOHNSON. And you would not contemplate that any of those peaceful uses would be within the Defense Department?

Dr. DRYDEN. That is my understanding of the language of the bill, sir.

Senator JOHNSON. Now, you don't believe in a board with full directive powers under this measure and you have a provision that each agency must concur and the President must agree before something can be transferred into a space agency from an agency that is now doing it. Under this bill that you have approved and recommended to the Congress, who is going to make the decision as to who controls what?

Dr. DRYDEN. There is a provision for the transition period. At the present time, the situation is that the Defense Department has been authorized by the Congress to carry on the civil space function.

Senator JOHNSON. I understand that. Now who, under this bill, is going to decide what is civilian and what is military?

Dr. DRYDEN. If this bill is passed?

Senator JOHNSON. Let's assume it is passed. Answer the question on that basis.

Dr. DRYDEN. It will be resolved, in the first instance, by negotiations between the new Agency and the Department of Defense.

Senator JOHNSON. Who is going to make the decision? That is all I'm asking you.

Dr. DRYDEN. If there is a controversy, it goes up the line to the President, like any other controversy between agencies.

Senator JOHNSON. So the President is going to decide what is civilian and what is military in each instance?

Dr. DRYDEN. I don't think it is going to go to the President in each instance.

Senator JOHNSON. Then it will go to the President where there is a difference of opinion?

Dr. DRYDEN. I think those will be relatively few.

Senator JOHNSON. I didn't ask you how many you thought there would be. I just asked you who will decide the issue when there is a dispute.

Dr. DRYDEN. It will be decided, as other disputes between Government agencies are decided, up the line to the President. The heads of other departments report to the President of the United States. That is the next level of authority.

ROLE OF UNITED STATES AS SPACE LEADER

Senator JOHNSON. Do you have any suggestions that you would like to make to the committee about preserving the role of the United States as a leader in aeronautics and space science?

Dr. DRYDEN. Any specific suggestions?

Senator JOHNSON. Yes.

Dr. DRYDEN. I think the most straightforward way is to support a forward-looking program in this new Agency.

REPRESENTATION ON NATIONAL SECURITY COUNCIL

Senator JOHNSON. Would you favor giving the Director of this new space Agency a seat on the National Security Council?

Dr. DRYDEN. I think that that is not necessary until we see how the Agency develops. It deals with questions outside the Security Council, with the peaceful uses.

RELATIONSHIP TO ARPA

Senator JOHNSON. I have this final thought. Is the present development of nonmilitary space projects by ARPA delaying the development of a comprehensive, well-planned program, in your opinion?

Dr. DRYDEN. No, sir. We are in very close contact with ARPA. The ARPA witnesses appeared before you; we are talking about the same program. The effect of the bill is ultimately to change the top management, but it will not affect the work that is going on.

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SUGGESTED CHANGES IN THE BILL

Senator JOHNSON. Do you plan to ask the military and the Director of the Budget to make available to you at the earliest possible moment any corrections or changes or improvements they are going to recommend so that the committee may have your concurrence before taking final action?

Dr. DRYDEN. Yes, sir, I will do that.

Senator JOHNSON. Do you have any improvements that you desire to suggest now?

Dr. DRYDEN. Yes.

Senator JOHNSON. Other than the international cooperation paragraph you mentioned?

Dr. DRYDEN. Yes, we have made 2 or 3 other suggestions.

Section 5 (a) on page 4 of the bill, under "Functions of the Board"—as a result of discussion in the House, we proposed to take out the second sentence requiring the Board to make an independent annual report. We think that an Advisory Board can make a report any time that it likes, and it is not necessary to require it to make an annual report. The work of the Agency will be reported to the Congress through the President under another section of the bill.

We also felt that——

Senator JOHNSON. So you would eliminate, beginning with the word "The" in line 19 and——

Dr. DRYDEN. Lines 20 and 21; yes, sir.

Senator JOHNSON. All right. Next?

Dr. DRYDEN. The next one under 5 (b), to put a period after the word "Director," in line 23, and not to place in this language the putting of a limitation on the President as to when he shall or shall not make a nomination.

Senator JOHNSON. Would you repeat that again? What line, what page?

Dr. DRYDEN. On page 4, the last line on the page, it says:

> And the Director shall not be appointed until the Board shall have had a reasonable opportunity to make such recommendations.

This was in the first instance copied from the National Science Board Act. We do not think that it is necessary to put such a restriction on the President.

Senator JOHNSON. All right. What do you propose?

Dr. DRYDEN. To simply omit line 24 and lines 1 and 2 on page 5. I have already suggested that in section 5 (c) in line 4 on page 5 the words, "prior to," be replaced by "on," to make it very plain that the Board is not to be a step which can hold up action.

Senator JOHNSON. So you would eliminate the words, "prior to."

Now, your previous recommendation would read, beginning on line 22:

> The Board may make recommendation to the President with respect to the appointment of a Director.

Is that correct?

Dr. DRYDEN. Yes, sir.

Senator JOHNSON. Why do you have to say that? It doesn't mean anything, to begin with. Why not eliminate all of it? I don't guess anybody would go to jail if he made a suggestion without its being spelled out here.

Dr. DRYDEN. The Director would receive the consideration of the people who are active in the field, who know the technical aspects, the military aspects, and the governmental aspects.

Senator JOHNSON. I assumed the intent was to give the President the Board's views in the matters.

Dr. DRYDEN. That was the intent.

Senator JOHNSON. The way you are wording it, it is not necessary that he receive that viewpoint. It is not a condition or requirement. He doesn't need to receive it at all. He can go on and act without it.

Dr. DRYDEN. I think with this language in the law, the President would act on recommendations of the Board. The other language reads like a restriction on the President.

Senator JOHNSON. Do you have any other suggestions?

Dr. DRYDEN. In section 6 (b) (6) on page 8, in line 23, it has been pointed out to us that the language as it now reads permits any governmental agency to transfer supplies, equipment, aircraft, missiles, to the Agency, and that this should be a two-way street. In addition to "transfer to," add the words, "or receive from" so that it would be possible for the agency to turn over a space craft which it had developed to the military, as well as for the military, as it now does, to turn over to us aircraft and missiles for research and test purposes. So this would make it a two-way street, rather than a one-way street.

On the security clause, section 7 on page 13, there have been some reservations on the part of the Atomic Energy Commission. I believe Admiral Strauss testified about this before your committee. There is in process a working out of language on this provision which is mutually satisfactory.

Senator JOHNSON. So you expect some amendments on section 7 before we write up the bill?

Dr. DRYDEN. Yes, sir; we expect to have this in the next few days.

Senator JOHNSON. And conferences are now taking place between your group and Admiral Strauss' group?

Dr. DRYDEN. With the Atomic Energy Commission; yes, sir, that is correct. They are in the nature of perfecting amendments.

In section 7 (b), on page 14, line 12, there is a perfecting amendment. This deals with violation of regulations with respect to protection or security, and it is or should be amended to include equipment in the custody of contractors. It is a rather long sentence: "Whoever shall willfully violate, attempt to violate, or conspire to violate any regulation or order," down through "other property or equipment in the custody of the Agency," it is suggested in line 12 to add, after "Agency," the words "or any real or personal property or equipment in the custody of a contractor by virtue of a contract with the Agency."

Then strike the words "shall be guilty of a misdemeanor and," on lines 12 and 13.

Senator JOHNSON. Do you have any other amendment?

Dr. DRYDEN. That is all.

Senator JOHNSON. Would you submit all of those suggestions in writing?

Dr. DRYDEN. I'll do that, sir.

Senator JOHNSON. Senator Green, will you preside for a moment? I must go to the phone.

Senator Mundt, you may proceed with any questions you have.

ANNUAL REPORT FROM THE BOARD

Senator MUNDT. This first perfecting amendment in section 5 (a) on page 4, Doctor, I wasn't sure I understood your reasons for eliminating the necessity of the Board's making an annual report. It seems to me it is just a sort of orderly procedure for these various boards and commissions at regular periods to make these reports so you can compile a library of their recommendations and their activities. Unless there is some good reason why the Board should not write up an annual report, I would think this language is good.

Dr. DRYDEN. Well, again, I do not really object to the language. The reasoning behind it was that the Board—the activities of the Agency—are reported to the Congress through the President by the Director. Now, a report of the Board would necessarily cover a great deal of the same ground, and it was felt that the Board has the prerogative, being advisory to the President, to submit a report at any time, a report on special matters, and they would not want to repeat the activities of the Agency in a separate report.

Now, as I say, I do not object to the language, but it was thought this was perhaps an unnecessary requirement.

Senator MUNDT. In other words, you have no particular objection if we leave the language as it is.

Dr. DRYDEN. No, sir; that is correct.

Senator MUNDT. Mr. Chairman, I think I have no other questions. You may proceed, as far as I am concerned.

Senator GREEN (presiding). The only thing I want to do is impress upon you the importance of finishing these records so that they may remain as complete as possible at as early a date as possible.

Dr. DRYDEN. I will very promptly, sir.

Senator GREEN. Does no one else have any questions?

Mr. WEISL. May I ask a question?

Senator GREEN. Counsel for the committee.

QUESTION OF RESEARCH AND/OR OPERATION IN NEW AGENCY

Mr. WEISL. Dr. Dryden, the title of this bill reads, "To provide for research into problems of flight within and outside the earth's atmosphere, and for other purposes." Then the bill provides further that the Agency "shall develop, test, launch, and operate aeronautical and space vehicles."

Dr. DRYDEN. That is correct.

Mr. WEISL. Does this mean that the Agency will operate the test vehicles after they are perfected, or merely use them for research purposes?

Dr. DRYDEN. This means, Mr. Weisl, that the new Agency would take over the top responsibility for the satellite programs that are now going on, both the Vanguard program, if this is continued, and the Explorer program. This Agency would be responsible. It is my concept that the same people who are now engaged in these activities would continue to be engaged in them, that the bill is written in such flexible fashion, with such authorities for making contracts and making agreements, that it could be worked out so that no interruption would take place in the programs now going on.

Mr. WEISL. I wasn't referring to that. I was referring to the operation of test vehicles after they are perfected. Suppose you

perfect a space platform. Who operates that platform? As I understand this bill, it deals primarily with research and not with the operation of the vehicle after it is perfected.

Dr. DRYDEN. I think, then, the reading of the title is perhaps somewhat misleading. I cannot answer your question fully because this is a part of the unknown, but I can at least give you a hypothetical example.

I believe it is the function of this Agency, for example, to continue the development of satellites for meteorological purposes. Now, I have conceived, and I believe that the intent, is that this Agency would operate such vehicles for the Weather Bureau, that you would not have 8 or 10 Government agencies independently putting up satellites; that this Agency would be the operating Agency. The Weather Bureau would work out the instrumentation it desired to use; we would work very closely with the Weather Bureau; but this Agency would be the Agency actually responsible for putting satellites into space as a service for the Weather Bureau.

Mr. WEISL. But after those satellites are in space and have been perfected, will this Agency continue to operate them and supply communications information, weather information, reconnaissance information, to the Weather Bureau, to the Army and Navy and Air Force?

Dr. DRYDEN. The Agency will have, must have, certain facilities all over the world for keeping track of satellites put into space.

Mr. WEISL. But I'm speaking of after a vehicle is perfected by research. Will this Agency have the responsibility of operating that vehicle permanently? There is no distinction between section 6 (a) (3) on page 6 and the definition of the title of this act on page 1 which deals primarily with research.

Dr. DRYDEN. May I say it this way? I do not understand the bill to provide that this Agency should operate all space vehicles. But I do believe that it is meant to provide that the Agency should be able to operate space vehicles.

Mr. WEISL. But who will operate space vehicles for a civilian or peaceful purpose after they are perfected?

Dr. DRYDEN. It is my understanding that, at the present time, if this law is passed, it will be the responsibility of this Agency to do it. This is something that could be changed by Congress as the subject develops. I don't believe we can foresee the conditions of operation of satellites for more than a few years ahead to see what the problems will be.

Looking to the very distant future, there will have to be some provision, corresponding to that of the CAA, for traffic control, to the Federal Communications Commission for assignment of frequencies, to avoid interference, and so on. I don't think we can see quite that far ahead at the present time to know how to spell out in detail what is required for such purposes.

Senator MUNDT. Mr. Chairman, will counsel yield?

Senator GREEN. Yes.

Senator MUNDT. I wonder if the point you are getting at, Mr. Counsel, might not be covered in section 6 (b) (3) on page 7:

> To acquire, construct, improve, repair, operate, and maintain laboratories, research and testing sites and facilities, manned and unmanned aeronautical and space vehicles—

and so on. The word "operate" is included there. So, I would think the Agency does have the power to operate.

Dr. DRYDEN. My understanding is that the Agency is to be set up as a central agency for the civilian uses of space, peaceful uses of space. This is my understanding of the intent of the legislation, which includes operation.

NACA AS AN OPERATING AGENCY

Mr. WEISL. Under Secretary MacIntyre testified before us the other day that the NACA is not only an advisory agency but an operating agency as well, and that it has already entered the field of outer space. Do you agree with that testimony?

Dr. DRYDEN. In the research way. We have not, in the NACA, fired any satellites. We have participated in projects to study the problems of space. We have fired experimental rockets to very high speeds and very high altitudes. The word "Advisory" in the name has been a misnomer since 1926. The last advisory action of the NACA was in connection with the Air Commerce Act. Since that time, it has been a research agency, research and development agency, supporting the military and civilian programs, advancing the technology of aeronautics. We have flown airplanes. Our pilots happened to be the first ones to fly at Mach 1, Mach 2, and Mach 2½. We do fly airplanes; we do fly rockets. It would be very gratifying if some of the committee could visit some of our installations and see what is actually going on.

ADDITIONAL POWERS FOR NEW AGENCY

Mr. WEISL. If the NACA Act were amended to include and add some of the provisions of the Space Agency, could you operate satisfactorily?

Dr. DRYDEN. I do not think so, sir, because of the functions of operation and development, and I wish to repeat it is my interpretation that the NACA is abolished by this act; that its several hundred million dollars worth of facilities and trained research teams are used as a foundation, but that a new agency is being created which will take new people, new types of people, in many instances. You are starting a brandnew civil agency, except you are using the resources you already have, instead of beginning with nothing.

Mr. WEISL. But, by giving the NACA this added authority to hire new people and to operate, wouldn't that perform all the objectives and aims of the present bill?

Dr. DRYDEN. No, sir. There are at least four principal things that I can think of immediately. We do not now have the power to procure airplanes or space vehicles, for instance.

Mr. WEISL. Suppose you were given that power.

Dr. DRYDEN. I do not understand the difference between retaining the name and giving the provisions of this law and establishing a new agency.

Mr. WEISL. You now have an agency that has functioned for 43 years.

Dr. DRYDEN. Yes.

Mr. WEISL. Everyone has testified that it has functioned satisfactorily and well.

Dr. DRYDEN. Yes.

Mr. WEISL. The question I ask is: If NACA were given the additional powers needed, could NACA carry out all of the aims of this bill?

Dr. DRYDEN. I think that this is a question of semantics. You could retain the name. But if it gets these new powers of procurement and development, much larger contract authority, much greater operation by contract, it will be a different agency and, in fact, a new agency even though you call it by the same name.

CONCENTRATION OF POWER IN A SINGLE DIRECTOR

Mr. WEISL. Now, you testified that you believe in the power, authority, and responsibility of one director.

Dr. DRYDEN, Well, I said that this is a means of concentrating the power and line of authority so that you know who is responsible, There is no division of responsibility. It is the ordinary line operation of the Government. There is a Cabinet officer, a bureau chief, and so on. This is the same type of operation.

Mr. WEISL. But you say you believe in that type of operation?

Dr. DRYDEN. For procurement and operations, I think this is, undoubtedly essential.

Mr. WEISL. Do you believe that the authority and responsibility of such a powerful person should be clearly defined and limited by law?

Dr. DRYDEN. Again, I do not know exactly what you have in mind. I think it should be limited in the same sense that the powers of a Cabinet officer or anybody else are limited. I don't know what you have in mind, specifically sir.

Mr. WEISL. I have in mind the vesting of dictatorial and sole power in one man. Is there any other agency that vests such power in one man?

Dr. DRYDEN. I think every large operating agency in the Government operates with a single head.

Mr. WEISL. The Atomic Energy Commission has a Chairman with several members, but each member has a vote. The Chairman alone doesn't decide policy or direct the agency. The Federal Trade Commission, the Federal Communications Commission, the Federal Power Commission, the Tariff Commission—every agency that I have heard about or read about—each has a board where no one person is the dictator or the sole authority.

Dr. DRYDEN. Of those you have mentioned, sir, the Atomic Energy Commission is, to my knowledge, the only operating agency, the only one carrying on hardware-type operations. Now, the Atomic Energy Commission, that type of organization, in my opinion, has some built-in problems. You have five people with the authority very uncertain between them. The delineation of the authority of 5 people with respect to each other, I think, is much more difficult than the delineation of authority in 1 person. The Atomic Energy Commission, of course, has operated very well. I think any agency may be made to operate well if the people wish to make it operate well. The people are more important than the organization chart.

Mr. WEISL. Doesn't the Defense Department have hardware?

Dr. DRYDEN. They have a single head, the Secretary of Defense.

Mr. WEISL. Isn't that the dispute, that each military department is "separately administered" although under the control of the Secretary of Defense?

Dr. DRYDEN. I'm not an expert on that particular matter.

Mr. WEISL. You have read the testimony before the House committee. The complaint of the administration is that the words giving the Secretary of Defense direction and control do not supersede the words, "separately administered," as used in defining the power of the Army, the Navy, and the Air Force. That is one of the things they want to clarify.

Here the language is less definite than that.

Dr. DRYDEN. I don't want to enter into a discussion of the organization of the Department of Defense, because I'm not an expert in that field. I do know if you want a space program which moves forward, you must clearly define the responsibility. If you leave it ambiguous, you are going to have delays.

Now, I understand the risks of 1 person, but 1 person is removable. He is not a permanent fixture; he has no real tenure status other than that by the Congress and the President.

QUESTION OF IMPORTANCE OF ADVISORY BOARD

Mr. WEISL. Do you believe that the advisory board of 17 is very important to this agency?

Dr. DRYDEN. I do, and I tried in an earlier reply to give the several functions which I thought this would fulfill. They are one way of having people who know something about the space business keep an eye on the operations, and if this dictator gets a little bit off the beam, they are in a position to make a noise and do something about it very promptly.

Mr. WEISL. In view of the importance of these men, do you think that they should be confirmed by the Senate of the United States, as all other commissioners are so that Congress might have some control?

Dr. DRYDEN. There again I personally would have no objection. This is a matter for your committee to consider.

Mr. WEISL. But this bill does not provide for confirmation of this Board.

Dr. DRYDEN. This is correct.

Mr. WEISL. Would you recommend that the bill provide for confirmation of these important commissioners by the Senate?

Dr. DRYDEN. I do not specifically recommend it. I think that the level of importance is that of an advisory group to the President and to the Director. Now, whether Congress thinks that they should be confirmed by the Senate is a matter for Congress to decide. The present board, of course, is not confirmed by the Senate. It is a Presidential board—an unpaid board.

Mr. WEISL. You mean of the NACA?

Dr. DRYDEN. The NACA is not confirmed by the Senate.

Mr. WEISL. But you have testified that NACA is not an operating agency in the sense that the new Agency would be.

Dr. DRYDEN. Not in the sense of procurement and operation of hardware. It is a research and development agency. It operates in the research field.

SETTLING MILITARY-CIVILIAN DISPUTES

Mr. WEISL. In answer to the Chairman's question as to who determines what is civilian and what is military, you said, "the President."

Dr. DRYDEN. I said the disputes between the NASA and the Department of Defense have to be settled by the President. It is the only method within the executive branch that I know of for settling disputes between independent and Government departments or agencies.

Mr. WEISL. Could not the Congress provide in the law that certain officers or certain appointed men on this Board or in this Space Agency could settle such disputes?

Dr. DRYDEN. You could provide for that, but you would then be giving the responsibility, so to speak, to an interested party affiliated with one of the parties in dispute.

Mr. WEISL. No; I'm talking about a representative of each party in dispute. As an example, why couldn't the Secretary of Defense, and the head of the National Academy of Science, or the Secretary of Defense and the head of the Space Agency, determine what is civilian and what is military, and in the event that they couldn't agree, then go to the President?

Dr. DRYDEN. That is exactly what the bill provides.

Mr. WEISL. It doesn't provide that. In what part of the bill is such provision made?

Dr. DRYDEN. Perhaps I am going beyond this. It seems to me when you have two independent agencies of the Government, they try to settle their differences between them before they go to the President. I would expect the Secretary of Defense and the head of this new Agency to settle their disputes as far as possible. If they cannot agree, the structure of our Government provides that they move to the next level, which is the President.

RELATIONSHIP WITH INTELLIGENCE AGENCIES

Mr. WEISL. Now, this bill provides that the purpose of the bill is, in general terms, to provide for leadership by the United States in outer space exploration.

Dr. DRYDEN. That is correct.

Mr. WEISL. In order to do that, we must know what other nations are doing?

Dr. DRYDEN. Yes, sir.

Mr. WEISL. Do you know whether the intelligence agencies of the Government were consulted as to what they knew about what other governments were doing in outer space before this bill was drafted?

Dr. DRYDEN. I do not know about the members of the drafting committee. I am very intimately associated with intelligence work, and am pretty familiar with what is known through various affiliations.

Mr. WEISL. Do you believe it is important for this Agency to know what other nations are doing in outer space?

Dr. DRYDEN. Absolutely.

Mr. WEISL. You do?

Dr. DRYDEN. I do.

Mr. WEISL. Do you think some representative of the intelligence agencies should be a member of the board?

Dr. DRYDEN. I do not think this is necessary. I say at the present time the NACA has very close ties with the intelligence agencies, and it is in very close touch with the information they have. I don't see that it aids to have a representative of the intelligence agencies on this Board. These are day-to-day operating matters.

Mr. WEISL. That is all I have to ask, Mr. Chairman.

Senator JOHNSON. Thank you very much, Dr. Dryden. We'll remind you to submit for the record your written recommendations in connection with any change you may wish to suggest in the bill as submitted.

You are excused Dr. Dryden.

(The material requested of Dr. Dryden is as follows:)

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS,
Washington, D. C., May 14, 1958.

Hon. LYNDON B. JOHNSON,
Chairman, Special Committee on Space and Astronautics,
United States Senate, Washington, D. C.

DEAR SENATOR JOHNSON: I wish to express my appreciation for the courtesies extended to me when I appeared as a witness before your committee in support of S. 3609.

During my testimony, I suggested certain language changes in the bill which you requested in writing. The suggested revisions follow:

Section 5 (a), page 4, strike last sentence of this subsection (commencing on line 19 and continuing on lines 20 and 21) which reads, "The Board shall make an annual report and from time to time such other reports to the President as it deems appropriate." It appears that the Board, being advisory, would make such reports as it considers necessary to the President and the Director.

Section 5 (b), page 4, place a period after the word "Director" on line 23 and strike line 24 on page 4 and strike lines 1 and 2 on page 5.

Section 5 (c), page 5, strike the words "prior to" of line 4, page 5, and insert in lieu thereof the word "on".

Section 6 (b) (6), page 8, insert after the words "transfer to" on line 23, page 8, the words "or receive from". This would permit the Agency to receive equipment, aircraft, and other vehicles and to return such equipment and vehicles, and would permit other agencies to receive such equipment.

Page 13, insert a new section 7 entitled "INTERNATIONAL COOPERATION" to read as follows:

"The Agency may engage in a program of international cooperation in work done pursuant to this Act and in the peaceful application of the results thereof, pursuant to agreements negotiated by the Department of State or approved by that Department."

Consequently, sections presently numbered 7, 8, 9, and 10 would be renumbered 8, 9, 10, and 11, respectively.

Section 7 (b), page 14, lines 12 and 13, strike the words "shall be guilty of a misdemeanor and" and insert in lieu thereof the following: "or any real or personal property or equipment in the custody of a contractor, by virtue of a contract with the Agency." This subsection deals with violations of orders promulgated. This suggested revision would also protect property in the custody of Agency contractors.

Section 10 (b), page 16, line 21, after the words "National Aeronautics and Space Agency" insert the words "or his designee."

During the testimony of Mr. Maurice H. Stans, Director of the Bureau of the Budget, he made the following suggested changes in the language of S. 3609:

Section 2, page 2, lines 9 and 10, strike the words "in which case the Agency may act in cooperation with, or on behalf of, the Department of Defense," and insert in lieu thereof "in the case of which activities the Department of Defense shall be responsible."

Section 4 (a), page 3, line 18, strike the words "not to exceed."

Section 4 (a) (1), page 3, line 20, strike the words "no more than eight" and insert in lieu thereof the word "nine".

Section 4 (a) (1), page 3, line 23, strike the word "one" and insert in lieu thereof the word "three".

I endorse the above suggestions made by Mr. Stans.

Sincerely yours,

HUGH L. DRYDEN, *Director.*

Senator JOHNSON. Our next witness is Dr. H. Guyford Stever, Chairman, National Advisory Committee for Aeronautics Special Committee on Space Technology, and associate dean of engineering, MIT.

I ask consent to insert Dr. Stever's biography in the record at this point.

(The biography referred to is as follows:)

BIOGRAPHY, DR. H. GUYFORD STEVER, ASSOCIATE DEAN OF ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Dr. Stever was born in Corning, N. Y., on October 24, 1916. He received his AB from Colgate University in 1938 and his Ph. D. from the California Institute of Technology in 1941.

He was a staff member at MIT from 1941 to 1942, and associate professor from 1946 to 1951, associate professor from 1951 to 1955. He became professor of aeronautical engineering in 1955 and now holds the position of associate dean of engineering. He is also Chairman of the NACA Space Committee.

He was a liaison officer for the ORSD from 1942 to 1945, consultant to the Joint Chiefs of Staff in 1945 and member of the Research and Development Board from 1946 to 1948. He has been a member of the Air Force Science Advisory Board since 1947 and Vice Chairman since 1956.

He is a fellow of the Institute of Aeronautical Sciences, the American Academy of Arts and Sciences, the American Association for the Advancement of Science, the American Physical Society, and is a member of Phi Beta Kappa, and Sigma Xi.

Senator JOHNSON. I have an important meeting at 11:30, and I have asked some of my associates to preside in the event I am called away, so Dr. Stever, I hope you will understand that it is no discourtesy to you.

Dr. STEVER. Yes.

Senator JOHNSON. I have other duties to which I must attend.

Dr. Stever, do you care to make a statement on this bill to the committee?

Dr. STEVER. Yes, sir.

STATEMENT OF H. GUYFORD STEVER, ASSOCIATE DEAN OF ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, AND CHAIRMAN, SPECIAL COMMITTEE ON SPACE TECHNOLOGY, NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

Dr. STEVER. Mr. Chairman, members of the committee, and counsel; in laying the groundwork for our Government's major venture in astronautics and space technology, as this committee is helping to do, the most important consideration, I believe, is that this activity will be of long duration and of growing importance. Man's interest in the physical universe outside this earth and his desire to explore this earth——

Senator JOHNSON. Dr. Stever, I'm having a little difficulty following you.

Dr. STEVER. I'm sorry.

Man's desire to explore that universe is very old and very intense. A member of a great senate long ago, Cicero, the great Roman lawyer and statesman, was interested in this subject and, in fact, wrote about it.

Man's capability to explore physically and to send scientific apparatus well out into space is something which has been realized only in our generation. As this capability develops, I am sure his interest

will grow even stronger, as it has in the past. Because of all this, I believe we must plan an organization capable of giving us strength over many years, an organization capable of marked growth. I believe that we must not be overly influenced by the desire to do something spectacular on a short-term basis. We must lay a strong foundation, both organizationally and technically.

The phases of astronautics and space exploration activities which have yielded returns are the scientific and military phases. You are well aware of the rapid exploitation of these techniques in military technology, so I will not detail them. I am confident that this military exploration should and will continue, and that from it not only will come increased military strength, but also knowledge, techniques, and equipment which can be used for our nonmilitary space activity.

Our nonmilitary space program, though not controlled by the military, should be in close contact with it for mutual exchange of ideas, data, techniques, equipment, and even bases.

With respect to scientific research, both to learn more about the physical universe outside the confines of the earth and to use this cosmic laboratory for a better understanding of the physical laws which govern physical processes here on the earth as well, these rocket techniques are unfolding a wealth of interesting possibilities. This scientific research, already well started, should grow apace.

What of the other nonmilitary aspects of astronautics and space exploration? Already we have seen some simple engineering ventures of practical use involving communication relay stations and weather observation stations on satellites. Also, physical exploration of the solar system is something to begin in a limited way. There are some other long-term and highly imaginative accomplishments of space flight which are speculated on by some. Personally, I believe that there will evolve many important uses of these techniques of space flight as we develop our capabilities in the field, though I am not one to attempt to predict these in detail at the present time.

Much has been made of the argument as to whether we should immediately start sending men into space either on satellites or on moon rockets. On manned space flight, it is my feeling that we still have a long way to go on two counts. In the first place, we will not be sure until we have performed a substantial amount of experimentation how difficult it is to put a man out there and return him safely. In the second place, we are not yet sure why we want a man to go. Certainly, much of our scientific experimentation and, in fact, some rather distant space exploration can be done without involving manned space flight. I do believe that there are enough possibilities in the long-term future, both in military and nonmilitary ventures, for a man to be needed in space flight, that preliminary experimentation is justified. Of course, the country that first puts a man out there will gain prestige. However, if the choice is necessary, I would sacrifice early prestige for long-term strength.

There are several kinds of activities which might be conducted simultaneously in order to develop our capabilities optimally. In scientific laboratories, we must conduct research and develop equipment to perform the scientific experiments in space. In engineering laboratories, we must work on the techniques and the technical field which we must master before we can perform vastly more complicated flight into space. The flight work which we conduct must have at

least two purposes: First, to provide the vehicles for the transportation of scientific apparatus to whatever stations in space they must reach to perform the experiments; and, second, to develop and test new vehicles and flight techniques.

In considering the organization and program to accomplish all this, you must first note where our capabilities lie. Personally, I am one who believes that this country has very strong capabilities in this field and that our scientific, engineering, and industrial people will respond quickly to this challenge.

There are several sources of this needed talent. In the first place, within the Government we have the NACA with its laboratories and flight stations—Redstone Arsenal, and a large number of others, all of which have already conducted some important experimental work. There are other Government laboratories which have participated in the program of scientific experiment—the Naval Research Laboratory, the Air Force Geophysics Laboratory, and others.

There are a large number of university scientific laboratories which have been involved in scientific experiments. And, finally, we have strong industrial concerns interested primarily in the vehicle developments, but which in fact have expanded their interests and strengths quite a bit beyond.

The Government organization set up to handle astronautics and space exploration must tap all of these strengths.

Without going into great detail on the possible organizations to do this job, let me say for several reasons I favor the use of NACA as a nucleus of a new organization to conduct our nonmilitary work in astronautics and space exploration.

In the first place, the NACA laboratories have already done and are continuing to do a great deal of work in this field, particularly in research on flight techniques. One cannot divide technical fields, and I believe that all of the problems of flight stretching over the spectrum from the low speed, low altitude flight in the atmosphere, to those of very high speed, high altitude flight outside of the atmosphere, are best solved in a single agency encompassing them all.

In the second place, NACA's relationship with the National Science Foundation and the National Academy of Sciences, and the scientific community at large, is such that they can use important scientific research capabilities outside of their own organization.

In the third place, NACA has a longstanding, close relationship with the military organizations. There is a great overlap in the military and the nonmilitary uses of equipment for space exploration and experimentation. The new organization can use these well-founded relationships: First, to help the military solve its problems; and, second, to help itself by occasionally using military equipment.

It is important to consider this a new organization rather than an expanded NACA, for it must have a capability to contract with industry and academic institutions on a scale far larger than NACA has had in the past.

Finally, there is one important point which is fundamental to this entire operation. It is a point which is more general than just space technology. It has to do with the delegation of authority and responsibility once the program is decided upon.

In those stages in which we are now—essentially discovering what our objectives are, what our organization should be, and what general

program should be followed—I think it is important to tap all of the ideas from all sources.

As we begin to carry out this program, we must continue to tap these ideas from capable organizations and individuals to find out what experiments to perform and to discover new techniques.

But, having decided upon an experiment or a program of experiments, a program of flights, I believe it is essential that the responsibility and authority be delegated to the working technical level. A very complicated superstructure of detailed technical management within the Government, I believe, has seriously hampered some of our most important projects in space technology to date.

I believe that the leaders within the current NACA understand this fundamental requirement for rapid progress in a technical venture.

Finally, I would like to give two reasons why I believe that the nonmilitary uses of space should be controlled by a civilian agency rather than the military agencies.

In the first place there is the reason that was given by Dr. Dryden: we should prove to the world that we are really interested in science for science's sake and for science to lay the foundation for long-term nonmilitary technical applications.

In the second place, I believe the Department of Defense has several space problems which are of such difficulty and on which so little progress has yet been made, that it will take all of their capabilities to master them.

Thank you.

Senator JOHNSON. Thank you very much, Dr. Stever.

RESPONSIBILITY OF DEPARTMENT OF DEFENSE

Doctor, I have a few questions.

The first one is: In your judgment does this bill adequately provide for the jurisdiction of the Department of Defense in connection with its responsibility to develop weapons systems, involving the use of outer space?

Dr. STEVER. Sir, I have not studied the bill in enough detail and I am not familiar enough with the legal procedures which must be gone through to insure this. I do know that cooperation must be very strong between them. I do know that the Department of Defense has some very important space technology programs over which they must have jurisdiction. But I believe that they should not have sole jurisdiction over the space program.

DECISIONMAKING POWERS

Senator JOHNSON. Do you think the bill adequately provides sufficient power to make decisions for the rapid development of nonmilitary space systems?

Dr. STEVER. By the new Agency; yes.

INTERNATIONAL COOPERATION

Senator JOHNSON. Do you believe the proposed legislation makes ample provision for international cooperation on nonmilitary space exploration?

Dr. STEVER. Again, I have not, primarily because of the lack of time, gone into the provisions of the bill on this point. I think that it is important if we are to accomplish the first objective which I stated, namely to prove to the world that we are interested in and will lead in the nonmilitary uses of space.

WEAPONS SYSTEMS RESEARCH

Senator JOHNSON. Should military weapons involving the use of outer space be researched to the stage of design development outside the Department of Defense?

Dr. STEVER. Should military weapons be designed?

I believe that military weapons should be designed within the Department of Defense or by contract to the Department.

Senator JOHNSON. Is it desirable to have a separate agency from the Department of Defense vested with total research power over all space systems, military and nonmilitary?

Dr. STEVER. No, sir; I believe that the military systems should be under the Department of Defense and the nonmilitary systems should be under the space agency, and that the overlap between them—and this should be recognized to be great, involving research, ideas, techniques, equipment, bases, and so on—must be handled some way.

DETERMINATION OF PROJECTS AND SPACE POLICY

Senator JOHNSON. Under this bill who would determine which agency would handle which projects?

Dr. STEVER. Well, as I read the bill—again I am only repeating what I have just heard from Dr. Dryden—most of the cases presumably would be treated by mutual agreement; those that were not, would be referred to the President.

Senator JOHNSON. Where under the bill do you believe the determination of national space policy would take place: in the Department of Defense or in the new Space Agency?

Dr. STEVER. I think that this is a very important thing which must be looked to. There are a number of activities in space in which a national space policy would have to be developed.

For example, in our NACA space technology committee, we have recognized as a serious problem the surveillance of space; that is, keeping track of all of the experimental equipment and military vehicles up there. The responsibility for this must be worked out in more detail.

Senator JOHNSON. Do you endorse the bill as written and urge its approval?

Dr. STEVER. Yes, sir.

Senator JOHNSON. Thank you very much, Doctor.

Senator Saltonstall? Senator Saltonstall is the ranking member. But, since he must also leave shortly, I will ask Senator Mundt if he would preside. I have an 11:30 meeting.

I would like to announce we will not convene until 2:30 this afternoon. We have a White House meeting at noon and I know I cannot be here before 2:30. If I am a little late, I will ask any member who may be here to go ahead and open the meeting. Senator Saltonstall, do you plan to be here this afternoon?

Senator SALTONSTALL. Mr. Chairman, I plan to be here this afternoon.

Senator JOHNSON. Will you preside?

Senator SALTONSTALL. I will ask Senator Mundt to preside because I have another committee meeting.

I would like to ask a couple of questions first.

Senator MUNDT (presiding). Very well. I will preside and will recognize the Senator from Massachusetts.

Senator SALTONSTALL. Thank you, Mr. Acting Chairman. I have just three questions, Dr. Stever.

RELATIONSHIP OF DIRECTOR TO BOARD

Did I understand you to say in your testimony that you believe that the Director should be in charge and the Board just a consulting board, so the Director will have the ability to make quick decisions?

Dr. STEVER. Sir, I believe that this is a very important organizational feature of any group which has the responsibility to put into effect a program which is agreed upon by our Government.

Senator SALTONSTALL. Well, then, do you believe that one man should be in charge?

Dr. STEVER. Yes, sir.

Senator SALTONSTALL. And that the Board should have no authority except a consulting authority?

Dr. STEVER. Yes, sir. I believe that is good organizational procedure not only at the agency level but at all the operating levels beneath it.

SETTLING DISAGREEMENTS

Senator SALTONSTALL. Now, you also brought out, when the chairman asked you a question, that when there is disagreement on a policy decision, as to whether a function is military or whether it is civilian, that decision ultimately, if there is a disagreement, has to be made by the President and nobody else, didn't you?

Dr. STEVER. Yes, sir.

Senator SALTONSTALL. You agree with that.

Dr. STEVER. I certainly do.

BASIC RESEARCH OUTSIDE THE MILITARY

Senator SALTONSTALL. Now, you stated, I think, to the chairman that you thought that all work relating to military security should be done within the Defense Department. Now, assume that there is some research to be done on space that ultimately might lead to military applications, that research can be done outside the Defense Department, can't it?

Dr. STEVER. Yes, sir. I would like to comment on that. Possibly I made some inaccurate statements. I referred, when I said that the military work should be done within the Department of Defense, to military weapons projects. I actually think that a great deal of technology which the new Space Agency should do will overlap the technology that the military organizations must work on. As in the past with NACA, I believe that the Department of Defense should ask the new Agency to cooperate when the new Agency's facilities are best equipped to do this work. On techniques, research, ideas, devel-

opment of component equipment, I believe there should be cooperation. When it comes to weapons systems development for military purposes, then I think that the Department of Defense should be responsible, and when it comes to flights of space vehicles for nonmilitary uses, I think they should be under the control of the new Agency.

Senator SALTONSTALL. In other words, the basic research is to be done outside the Department of Defense.

Dr. STEVER. Yes, sir.

Senator SALTONSTALL. When that basic research begins to lead to a weapon's application then that should be taken over by the Department of Defense?

Dr. STEVER. When it is clearly a weapon; yes, sir.

Senator SALTONSTALL. But not necessarily until then.

Dr. STEVER. I think that the military departments will from time to time be doing work that NASA will be very interested in; I don't think that one can take science and engineering research completely out of the Department of Defense.

Senator SALTONSTALL. Well——

Dr. STEVER. Some of their work is good for all sorts of peaceful uses.

Senator SALTONSTALL. You are a professor at MIT?

Dr. STEVER. Yes, sir.

Senator SALTONSTALL. I am a Massachusetts citizen. I am very proud of MIT and what it is doing. Isn't it true that with respect to many contracts that MIT has, it can't be specified that this is purely for military and that is purely for civilian applications. They may run into both.

Dr. STEVER. Yes, sir. That is correct.

Senator SALTONSTALL. And when it becomes apparent that a weapon may be developed from the research, then that should go over into the Defense Department.

Dr. STEVER. Yes, sir.

Senator SALTONSTALL. Thank you very much.

Thank you, Mr. Chairman.

Senator MUNDT. Senator McClellan, do you have any questions?

Senator MCCLELLAN. No questions. I arrived too late.

Senator MUNDT. Mr. Counsel?

QUESTION OF DEFINING MILITARY AND CIVILIAN PROJECTS

Mr. WEISL. Your definition of what is military and what is civilian is not consistent with the language of the bill, Dr. Stever. The bill defines as military anything that is peculiarly associated with or related to weapons systems or military operations.

Now, can you conceive of reconnaissance, weather, communications, not being related to military operations?

Dr. STEVER. Sir, I think—and I am deviating a little bit from your question—I think that we could define and write forever and try to distinguish between technical activity which was military and technical activity which was nonmilitary. There is a large area of overlap in space technology. In some cases it just depends upon the application. I think also that there are technical activities that the Air Force and Navy at the present time carry on, which are applicable to

aircraft systems that fly in the air, as well as space vehicles, both military and nonmilitary, and I don't think that we can deny them the right to do research and engineering work in this field.

POSSIBLE JURISDICTIONAL DISPUTES

Mr. WEISL. But in a bill such as this, shouldn't the Congress make every effort to prevent jurisdictional disputes and struggles for power?

Dr. STEVER. Yes, sir.

Mr. WEISL. And struggles for budgets?

Dr. STEVER. I think you should, but you should also recognize that there is an area of mutual interest which must be handled by mutual agreement or by the decision of the President. I don't think that you can write a bill that will ever eliminate disagreements over jurisdiction of the overlap areas. This is true not only for space technology. It is true for all of the other fields of science with respect to their military uses.

Mr. WEISL. It is very well to say that a bill can provide for settlement of jurisdictional disputes by the President, but isn't that rather unrealistic with an overworked President? Couldn't the bill provide for some decision-making board to make these decisions as to what is military and what is civilian promptly? Couldn't you have a committee consisting of a representative of the Department of Defense, the National Science Foundation, or similar representatives and have them decide rather than refer these matters to an overworked President?

Dr. STEVER. I think that there are a number of possible solutions. You must set up something in the organization which can decide these disputes.

Mr. WEISL. That is all.

Senator MUNDT. Under our Constitution the President is charged with the defense of the country, and while I can envision that a board of arbitration could be established such as counsel questioned you about, it would seem to me that if I were the President charged with the safety and the security of the country, that when you get disputes of this type, I would want to handle it. I was just wondering whether you have any observations as to the relative merits. I can see the excessive workload in the White House, but I don't see how the White House can shirk a responsibility imposed on it by the Constitution in this way.

Dr. STEVER. Sir, I would comment that the President has some other responsibilities such as looking out for the welfare of the Nation; he must use some judgment in determining between his different responsibilities. There must be some mechanism for getting decisions of this importance. Since I think these decisions on the areas of overlap are of major importance to the United States, I believe they should come from the top level of our Government.

Senator MUNDT. I am impressed by the fact that, speaking as you do as a member of the academic world, you have placed so much emphasis on the importance of the defense aspect of this program being handled by the Department of Defense. That, to me, is an encouraging indication that when we get this thing established, other scientists like you, if they are like-minded, might cooperate with the Defense Department so well that the areas of adjudication to be referred to the White House might be relatively few.

Dr. STEVER. I would hope so, sir.

Senator MUNDT. And——

Dr. STEVER. Personally I think that both the new agency, NASA, and the Department of Defense will have so many difficult tasks that they won't have much time to argue about overlap. They will probably want help from one another. It has worked out this way in the relationship between NACA and the military services in the past. There are many important things that the military services have asked the NACA to do for them.

Senator MUNDT. You speak from an abundance of experience in this field. That would be your best educated guess on that, would it?

Dr. STEVER. Yes, sir.

Senator MUNDT. Thank you very much for your testimony.

Senator McClellan?

NECESSITY FOR KEEPING CONGRESSIONAL COMMITTEES INFORMED

Senator MCCLELLAN. Mr. Chairman, I didn't get here in time to hear all the Doctor's testimony, but since this question has been raised about the setting up of a board to determine jurisdiction, what do you think of the device of having that board report its findings to the appropriate committees of Congress for their review?

Dr. STEVER. Again this is an area in which I am not expert, but I do feel that such a proposal has one merit. I will speak of that, and then I will mention some items on the debit side.

The merit it has is to keep a constant interest in Congress in this area of science and engineering which is going to be of growing importance. I think that it has been beneficial for the elected legislative members of the Government to show the amount of interest in space that they have up to now.

However, let me go back to an earlier comment; we cannot make the channels of authority and responsibility too complicated. From my experience that has been the principal factor which has delayed many of our important projects in this country, both military and nonmilitary. So I believe we must streamline these channels.

Senator MCCLELLAN. Well, you express my views regarding it. I still think that assuming this committee, or a similar committee, was made a permanent committee of the two bodies to constantly study and process legislation in this area, it would be well at least to require the Board immediately as it makes a decision to get that information to that committee. Whether there should be a waiting period to give the committee time to act, I am not prepared to say, but I do think if any such board is established, its decisions should be filed with the respective committees of the Congress having jurisdiction in that field so that they can keep informed, so they know what is going on, and not have decisions made without keeping the legislative sources informed. Thank you, sir.

Senator MUNDT. Thank you very much for very informative and instructive testimony.

Dr. STEVER. Thank you very much.

Senator MUNDT. We will stand in recess until 2:30, and again, our testimony this afternoon will be from the Bureau of the Budget.

(Whereupon, at 11:45 a. m., the committee recessed to reconvene at 2:30 p. m., the same date.)

AFTERNOON SESSION

Senator SALTONSTALL (presiding). The hour to which the committee was adjourned having arrived, the committee will be in order.

Our first witness this afternoon is Mr. Maurice Stans, Director of the Bureau of the Budget. He is accompanied by Mr. William Finan, the Bureau's Assistant Director for Management and Organization.

According to the testimony, Mr. Stans, your agency was the only one which really had an opportunity to consider this measure before it was sent up by the President. We have been told that it was whizzed through the Pentagon in a 24-hour period, without Defense officials commenting on it as it went by.

As a background for your testimony, I am inserting in the record a biography covering your life, your times and your travels.

I am also inserting a biography of Mr. Finan.

(The material referred to follows:)

BIOGRAPHY OF MAURICE H. STANS, DIRECTOR, BUREAU OF THE BUDGET

Maurice H. Stans took office as Director of the Bureau of the Budget on March 18, 1958. Prior to his appointment to this post by the President, he had been Deputy Director for 6 months.

Before coming to the Bureau of the Budget in September 1957, Mr. Stans had been Deputy Postmaster General for 2 years. During his service in the Post Office Department he took a major part in planning and directing the reorganization of the postal service and the modernization of the Department's management structure and operating practices.

His first experience in the Federal Government was in 1953, when he served on a task force which assisted the House Appropriations Committee in reviewing the Federal Budget for the fiscal year 1954. Subsequently, he was engaged for more than a year in a special study of postal fiscal systems and accounting practices for the Postmaster General.

He was formerly executive partner in the national accounting firm of Alexander Grant & Co. He holds the degree of certified public accountant from eight States.

For outstanding professional achievements he received the American Accounting Association Annual Award in 1952 and the American Institute of Certified Public Accountants annual award in 1954. He is a past president of the American Institute of Certified Public Accountants and a member of the National Association of Cost Accountants, the American Accounting Association, and the Federal Government Accountants Association.

Mr. Stans has won distinction as a big game hunter. He is an honorary member of the East African Professional Hunters Association, a member of Shikar-Safari Club and the Adventurers Club. His other club memberships include the Economic, Executive and Union League Clubs of Chicago, the Chemists Club of New York, and the National Capital Skeet and Trap Club of Washington.

He holds an LL.D. degree conferred in 1953 by Illinois Wesleyan University.

He received his college education at Northwestern and Columbia Universities.

He was born in Shakopee, Minn., on March 22, 1908.

BIOGRAPHY OF WILLIAM F. FINAN, ASSISTANT DIRECTOR, MANAGEMENT AND ORGANIZATION, BUREAU OF THE BUDGET

Mr. Finan was born in Memphis, Tenn. on February 11, 1913. He attended the University of Arkansas Law School in 1935–36.

Mr. Finan has held progressively responsible State positions in Arkansas, including secretary, Department of Public Utilities and acting State personnel director, 1933–39; administrative consultant, Public Administration Service, 1939–40 and 1941–42; organization and procedures assignments with Bureau of the Budget, 1940–41 and 1942–43; United States Army, 1943–45; Department of State, 1945–46; progressively responsible positions in Bureau of the Budget, 1946–52. He has been Assistant Director, Management and Organization, Bureau of the Budget since 1952.

He is a member of the American Society for Public Administration and the International Institute of Administrative Sciences.

Senator SALTONSTALL. Mr. Stans, the committee is ready for any statement you may have.

STATEMENT OF MAURICE H. STANS, DIRECTOR, BUREAU OF THE BUDGET; ACCOMPANIED BY WILLIAM F. FINAN, ASSISTANT DIRECTOR, MANAGEMENT AND ORGANIZATION, BUREAU OF THE BUDGET; ALAN L. DEAN, MANAGEMENT ANALYST, BUREAU OF THE BUDGET; AND KENNETH F. McCLURE, ASSISTANT GENERAL COUNSEL, DEPARTMENT OF COMMERCE

Mr. STANS. I have a prepared statement to present today, Mr. Chairman, but before I do so, I would like to make a few prefatory remarks.

As I am sure you know, I have been Director of the Bureau of the Budget for only 8 weeks, or more precisely, since March 18. Prior to that date, matters related to the establishment of a new space agency were handled, insofar as the Bureau of the Budget was concerned, by the then Director, Mr. Percival Brundage, together with his staff.

I did become familiar with the objectives and provisions of S. 3609 prior to transmitting the draft legislation to Congress on April 2. I have since given considerable thought to the bill and the issues which have risen in the course of the House and Senate hearings.

I am here in the hope that I can be helpful to the committee in explaining why the administration believes that early enactment of S. 3609 is so important. I will say in all frankness that I am not familiar with all the background factors which were considered in the preparation of the legislation. For this reason I am accompanied today by the following members of the staff who did the technical job of drafting the bill: Mr. William F. Finan, Assistant Director for Management and Organization, Bureau of the Budget; Mr. Alan L. Dean, management analyst, Bureau of the Budget; and Mr. Kenneth F. McClure, Assistant General Counsel of the Department of Commerce, who was detailed to the Bureau of the Budget for this purpose.

At the end of my statement I shall present certain amendments to the bill in the hope that they will satisfy certain objections which have been raised in the course of hearings before this committee.

AMENDMENTS TO THE BILL

Senator SALTONSTALL. Mr. Stans, the committee has received through its counsel, Mr. Weisl, certain proposed amendments which have been approved, we are told, by the Executive Office of the President and the Bureau of the Budget. They will be released at 2 p. m. today. They concern certain amendments in section 2 on page 2, lines 9 and 10; in section 4 (a) on page 3, line 18; in section 4 (a) (1) on page 3, line 20 and on line 23; and page 13, line 8, a new section 7 entitled "International Cooperation." (See p. 285 for text of proposed amendments.)

Have you seen those amendments?

Mr. STANS. Yes, sir.

Senator SALTONSTALL. Those you approve of?

Mr. STANS. Yes, sir; and I am prepared to offer them as amendments proposed by the administration to clarify some of the matters before the committee.

Senator SALTONSTALL. Were these amendments submitted to the Defense Department?

Mr. STANS. Yes, sir.

Senator SALTONSTALL. And they have the approval of the Defense Department, as far as you know?

Mr. STANS. That is right.

Senator SALTONSTALL. And by the Secretary of Defense?

Mr. STANS. The Secretary of Defense has approved them.

Senator SALTONSTALL. Will you proceed, sir?

Mr. STANS. As for the chairman's opening remark about the time which the agencies had to consider the bill before it came to the Congress, I should like to cover that later on in the course of my statement.

I am now referring, Mr. Chairman, to the prepared statement. The committee has already heard the views of many witnesses. I shall, therefore, in my statement, direct my remarks to the features of the legislation which, on the basis of previous testimony or questions raised by members of the committee, appear to require further amplification or explanation.

The National Aeronautics and Space Act of 1958 was drafted by the Bureau of the Budget at the instruction of the President and was transmitted to the Speaker of the House of Representatives and the President of the Senate on April 2, 1958. In preparing this legislation, the Bureau adhered strictly to the wishes of the President as set forth in his special message to the Congress of April 2, 1958. Throughout the drafting there was the closest exchange of views with the National Advisory Committee for Aeronautics and the President's Special Assistant for Science and Technology, Mr. James Killian. As transmitted to the Congress, the draft legislation had, and continues to have, the unqualified support of both the National Advisory Committee for Aeronautics and Dr. Killian. I should also like to assure the committee that the bill was circulated to the other interested agencies for their views, and that many changes were made in the draft in response to agency suggestions.

You have already been told that only a few days were allowed for agency review and comment. To keep the record straight, I should like to state that the bill was sent to the agencies on Wednesday, March 26, 1958, with a deadline for replies set at noon, Monday, March 31, 1958. Some agencies may not have received the draft until Thursday, March 27, but it was also true that agency comments were received and considered through the morning of April 1. Thus 5 to 6 days were given each agency, including the Department of Defense, to study and comment on the draft legislation.

I will grant that this is a short time for the review of an important bill and that this included a weekend. However, I should also like to point out that the major features of the legislation had been communicated to ranking officials of the most directly affected departments and agencies well in advance of the circularization of the draft bill. Furthermore, the President was particularly anxious to have the legislation go to the Congress prior to the Easter recess in order that the members of the congressional committees involved and their

staffs might have a week in which to examine the bill prior to the reconvening of Congress. In view of the urgent need for the Nation to move ahead with its space program, the President insisted that the Congress receive the administration's bill at the earliest possible date.

Many bills which are complex are found to require some perfecting amendments in the course of consideration by the Congress. The Bureau of the Budget and the National Advisory Committee for Aeronautics are eager to assist in any way to help clarify or otherwise improve the present text. It is my view, however, that the House and Senate hearings to date confirm the essential soundness of the concepts on which the bill is based. Furthermore, it is my conviction that the organizational and administrative provisions of the bill are in general well conceived and should be retained by the Congress.

In proposing this legislation, the administration was guided by a number of important considerations. Since these go to the heart of the matter, I should like to list them for the committee and comment briefly on each.

First, it was desired that the agency charged with the general furtherance of research into the problems of flight and astronautics be a civilian agency under civilian control. The President, in his special message on space science and exploration transmitted to the Congress on April 2, 1958, set forth this objective in the following terms:

> I recommend that aeronautical and space science activities sponsored by the United States be conducted under the direction of a civilian agency, except for those projects primarily associated with military requirements. I have reached this conclusion because space exploration holds promise of adding importantly to our knowledge of the earth, the solar system, and the universe, and because it is of great importance to have the fullest cooperation of the scientific community at home and abroad in moving forward in the fields of space science and technology. Moreover, a civilian setting for the administration of space function will emphasize the concern of our Nation that outer space be devoted to peaceful and scientific purposes.

I am gratified that almost without exception testimony before the House and Senate committees has endorsed the principle of civilian control over these aspects of space science and exploration aimed at furthering the general knowledge of mankind. The President has recognized from the outset, and the bill reflects this awareness, that certain space programs should be conducted under the Department of Defense because of their importance to the security of the Nation. On this there also seems to be no significant debate.

The issue which has come before this committee is that of determining where the line should be drawn between space programs and projects appropriate for the civilian agency and those more suitable for administration by the Department of Defense. S. 3609 attempts to resolve this problem in a number of ways. The bill's policy section specifically provides that aeronautics and space activities "peculiar to or primarily associated with weapons systems or military operations" shall not be under the control of the civilian Agency, although provision is made for the conduct by the civilian Space Agency of research on strictly military projects on behalf of the Department of Defense. As a number of witnesses, such as General Doolittle and Mr. Quarles, have pointed out, there will be a gray area where there is doubt as to whether an activity "may be peculiar to or primarily associated with

weapons systems or military operations." In such cases the assignment of responsibility will have to be determined by the normal processes of interagency cooperation. In some instances it will be necessary for the President, aided by Dr. Killian and other advisers, to resolve questions of agency jurisdiction.

The Bureau of the Budget has found that it is almost impossible in legislation to establish precise divisions between agencies with closely related programs. I don't think that it can be done here, especially when the future scope and dimensions of the program are so uncertain. The alternative would be to place all space activities in either the Department of Defense or the new National Aeronautics and Space Agency. I doubt that the Congress will wish to do either of those things.

I should like next to call attention to section 8 of the bill which provides for the transfer of related functions to the Agency. The purpose of that provision is to enable the agencies involved, with the approval of the President, to make those adjustments in their respective responsibilities as may be desirable. This provision will be especially important in the months to come, because the urgent need to move ahead with the space program has resulted in projects clearly civilian in nature being undertaken by the Department of Defense. These projects will in most instances be turned over to the civilian Space Agency as rapidly as it can be equipped to receive them, but this must be done on the basis of carefully worked out plans designed to minimize delay, duplication, or interagency conflict. Since the approval of the agencies surrendering functions is required, there is a guaranty that the National Aeronautics and Space Agency cannot on its own authority invade the proper spheres of other agencies or otherwise interfere with their responsibilities.

The second major objective sought by the legislation is to build upon existing institutions and to avoid increasing the total number of Federal agencies involved in aeronautics and space matters. The bill accomplishes this aim by utilizing the National Advisory Committee for Aeronautics as the nucleus of the new agency. As General Doolittle and Dr. Dryden have pointed out in previous testimony, the National Advisory Committee for Aeronautics has elaborate facilities adapted to work in space research. Its large and competent staff of scientists, engineers, and technicians is already conducting investigations of problems requiring solution if man is successfully to unlock the secrets of space. Because there is no clear dividing line between aeronautics and astronautics, it is but logical that the highly respected National Advisory Committee for Aeronautics should evolve into a Space Agency as man develops the capability to navigate outside the earth's atmosphere. Again I am gratified by the general recognition that the President's decision to build upon the National Advisory Committee for Aeronautics is a wise one.

The third objective of the legislation is to strengthen the present organization of the National Advisory Committee for Aeronautics in order to equip it to direct a large scale and urgent program with maximum effectiveness. The President has emphasized that he considers it vital that the new Agency be headed by a single official whom he and the Congress can hold accountable for results. In compliance with the President's instructions, the bill as transmitted to the Congress provides that a Director appointed by the President, by and with

the advice and consent of the Senate, shall head the Agency and shall exercise its functions. All administrative authority is thus placed in a single official appointed by and directly responsible to the President. This is the traditional way in which Federal agencies charged with large operating programs are headed. The Bureau of the Budget believes it would be a serious mistake to depart from this principle of a single responsible executive.

Some confusion has arisen concerning the provision in the bill for a 17-member National Aeronautics and Space Board appointed by the President. It is true that this Board is given the right to be consulted on major matters of policy, program, and Agency organization, and that it is authorized to make reports directly to the President. The text of the bill makes it clear, however, that while the Board has a right to be consulted and to be heard, it is a strictly advisory group. The Director alone, under the President, will be responsible for actions taken by the Agency.

The purpose of providing for a National Aeronautics and Space Board was to retain the best features of the present committee of the National Advisory Committee for Aeronautics, which is held in such high regard by everyone familiar with its work. This Board will facilitate cooperation between the Agency and other Federal agencies and with the scientific community in the conduct of the space program. The Board will also be of material assistance to the Director in discharging his responsibilities and to the President as an independent source of advice on space matters.

All members appointed to the Board from private life must be eminent in science, engineering, technology, education, or public affairs and must be selected on the basis of established records of civilian achievement. The conflict-of-interest laws of the United States will be fully applicable to them in their service on the Board.

The fourth objective of this legislation is to equip the National Aeronautics and Space Agency with those authorities which it will require to move ahead swiftly and effectively in a field in which many novel problems must be expected. I shall not attempt in my testimony to discuss these powers in full, but I should like to refer to several which General Doolittle and Dr. Dryden, as well as the Bureau of the Budget, believe to be of special importance if the Agency is to perform its functions with maximum effectiveness.

The authority to fix compensation at rates which are reasonably comparable with prevailing rates paid by non-Federal employers for similar work is very important for recruitment of the Agency's staff. Competitive compensation will enable the Agency to make effective use of research contractors and at the same time maintain the quality and morale of personnel employed in its Government-operated laboratories. Pay rates under this provision would be established and adjusted in accordance with regulations issued by the President. The Congress can be assured that the President's regulations will be designed to avoid serious disadvantage to other agencies not equipped with comparable authority. Furthermore, the actual rates set will be comparable to those of non-Federal employers only to the extent consistent with the public interest. It is not expected that the public interest will permit any of the employees of the agency to be paid more than the director himself, whose salary is set by the bill at $22,500 per annum. Approximately half the employees of the

National Advisory Committee for Aeronautics are "blue collar employees" and are now compensated on a prevailing rate basis. This additional authority will, therefore, permit an internally consistent pay system to be developed for the new Agency.

The importance of the authority of the Agency to enter into contracts has been covered in earlier testimony. Present law imposes on the National Advisory Committee for Aeronautics a limitation of $500,000 on contract research. This limitation should be removed and the contract authority of the National Aeronautics and Space Agency should be made sufficiently broad to enable it to make full use of the resources of non-Federal research organizations.

The authority to enter into cooperative agreements with the military services for the detail of military personnel to the Agency will help make possible the conduct of projects under the Agency's technical direction and at the same time enable appropriate military personnel to participate in the work performed. It is expected that both the Agency and the Department of Defense will gain substantially from such arrangements.

In a research agency it is essential that opportunities be afforded scientific and technical personnel to undertake further study at Government expense outside the Agency.

Adequate authority to arrange for and finance such training is included in the bill.

The question has been asked as to why the National Aeronautics and Space Act is required at all. It has been suggested that additional funds and possibly a few specific grants of authority would suffice to equip the National Advisory Committee for Aeronautics to carry out a space program. Such an approach would not meet the needs of the Nation's space program. Present legislation governing the National Advisory Committee for Aeronautics is fragmentary and has been accumulated piece by piece over the years. The name of the Agency has long since ceased to be applicable. The internal organization of the Agency should be strenghthened. The Agency should be equipped with broad and carefully considered powers to operate in the field of its responsibility. Special arrangements for interagency cooperation and the transfers of related functions are needed. The Congress of the United States and the President should join in adopting through this bill a comprehensive statement of the policy objectives of our Nation in the pursuit of space science and in the exploration of space. Comprehensive legislation is needed both to establish the machinery and authority to do the job ahead of us and to reassure the people of the United States and of the world that our country will move forward resolutely to maintain its leadership in the challenging field of space exploration. I therefore recommend that the Congress enact this bill in such form as to carry out the President's proposals.

Mr. Chairman, I have submitted a number of proposed amendments, as I stated earlier, that the administration endorses as changes to this bill in order to clarify some of the questions that have arisen in the course of the hearing.

(The proposed amendments referred to are as follows:)

PROPOSED AMENDMENTS TO S. 3609, NATIONAL AERONAUTICS AND SPACE ACT OF 1958

1. In section 2 on page 2, lines 9 and 10, delete the phrase "in which case the agency may act in cooperation with, or on behalf of, the Department of Defense." and insert in lieu thereof the phrase "in the case of which activities the Department of Defense shall be responsible."
2. In section 4 (a) on page 3, line 18, delete the phrase "not to exceed".
3. In section 4 (a) (1) on page 3, line 20, delete the phrase "no more than eight", and insert in lieu thereof the word "Nine".
4. In section 4 (a) (1) on page 3, line 23, delete the word "one" and insert in lieu thereof the word "three".
5. At the end of section 6 on page 13, line 7, insert a new section reading:

"INTERNATIONAL COOPERATION

"SEC. 7. The Agency may engage in a program of international cooperation in work done pursuant to this Act, and in the peaceful application of the results thereof, pursuant to agreements negotiated by the Department of State or approved by that Department."
And renumber subsequent sections.

Senator JOHNSON. Thank you very much, Mr. Director. Have you concluded?

Mr. STANS. Yes.

Senator JOHNSON. Mr. Russell, Mr. Green, Mr. McClellan, Mr. Magnuson, Mr. Anderson?

"CONFICT OF INTEREST STATUTES"

Mr. ANDERSON. Well, I first want to get to the question of this organization, but I was attracted on page 8 in the next to the bottom paragraph by this statement:

> The conflict of interest laws in the United States will be fully applicable to them in their service on the Board.

Can you cite us a conflict of interest law of the United States?

Mr. STANS. Senator, as I explained before you came in, I have with me the technicians who drafted the bill, and I'll ask Mr. McClure, counsel, to answer that question for you.

Senator ANDERSON. I would be happy to have you do so, because I just asked the Attorney General of the United States a short time ago if there was such a thing as a conflict of interest law. I have his opinion, and I would like to have Mr. McClure's opinion.

Mr. MCCLURE. Senator, there are seven principal prohibitions which are generally referred to as conflict of interest statutes. Would you like to have me give you the citations?

Senator ANDERSON. If you will give me a memo on them, because I didn't think there was a specific conflict of interest law.

Mr. MCCLURE. They are not cited as conflict-of-interest statutes, Senator, but as is often the case nowadays in legislation, they say early in the bill, "This bill shall hereinafter be cited as a conflict-of-interest statute." There are no such statutes, to my knowledge, that are officially so named. But they are commonly known as conflict-of-interest statutes. I'll indicate those, if you would care to have them.

Senator ANDERSON. Merely for the record.

(The citations referred to are as follows:)

CITATIONS OF CONFLICT-OF-INTEREST STATUTES

Title 18, United States Code, section 216	Title 18, United States Code, section 434
Title 18, United States Code, section 281	Title 18, United States Code, section 1914
Title 18, United States Code, section 283	
Title 18, United States Code, section 284	Title 5, United States Code, section 99

ADMINISTRATION OF FEDERAL AGENCIES

Senator ANDERSON. Now, page 7. You say:

> All administrative authority is thus placed in a single official appointed by and directly responsible to the President. This is the traditional way in which Federal agencies charged with large operating programs are headed.

I am just starting through the list of the independent agencies. The first principal one I come across, not bothering with the American Battle Monuments Commission, is the Atomic Energy Commission. Is that the way that is set up?

Mr. STANS. That is one of the principal exceptions to the rule.

Senator ANDERSON. Let's turn to the next one, the Civil Aeronautics Board. Is that the way that is set up?

Mr. STANS. That is not covered within the context of my statement. That is a regulatory agency, and not included in this category.

Senator ANDERSON. How about the Civil Service Commission?

Mr. STANS. The Civil Service Commission has three Commissioners.

Senator ANDERSON. Is it set up with a Director that runs it?

Mr. STANS. It does not have an operating program in the sense that this Agency will.

Senator ANDERSON. Well, I see the District of Columbia Redevelopment Land Agency. That has a program. How is it set up?

Mr. STANS. I'm not familiar with that, offhand.

Senator ANDERSON. How about the Export-Import Bank? That has a Board, hasn't it?

Mr. STANS. I think it has a Board; yes.

Senator ANDERSON. How about the Farm Credit Administration?

Mr. STANS. That has a large Board.

Senator ANDERSON. How about the Federal Civil Defense Administration?

Mr. STANS. That has a single Administrator.

Senator ANDERSON. How about the Federal Deposit Insurance Corporation?

Mr. STANS. That has a Board of Directors.

Senator ANDERSON. How about the Federal Communications Commission?

Mr. STANS. That is a regulatory agency and not comparable.

Senator ANDERSON. How about the Federal Power Commission?

Mr. STANS. That, too, is a regulatory agency.

Senator ANDERSON. How about the Federal Home Loan Bank Board?

Mr. STANS. I believe that has a Board of Directors, like the other banks you mentioned.

Senator ANDERSON. How about the Federal Mediation and Conciliation Service?

Mr. STANS. That, certainly, is not an operating agency.

Senator ANDERSON. Do you think this is the traditional way? Would you give me some samples, then?

Mr. STANS. The Department of Defense, Commerce——

Senator ANDERSON. Well, that is a Cabinet position. Those are wholly different from independent agencies, as you must recognize.

Mr. STANS. They are basic operating agencies of the Government, as you know, of course.

Senator ANDERSON. The Space Agency becomes a separate agency, does it not?

Mr. STANS. The Veterans' Administration is a large agency headed by a single Administrator. The Housing and Home Finance Agency is another.

NO MENTION OF THE AEC

Senator ANDERSON. In the preparation of this bill, as I mentioned many times before, you left out all mention of the Atomic Energy Commission, which is in the field of nuclear propulsion, and would seem to have some connection with it. It was included in the original drafts circulated, and then taken out. Could you tell us why?

Mr. STANS. I shall ask Mr. Finan to answer that question, since he handled and directed the draft of the bill.

Mr. FINAN. Senator Anderson, as far as I know, and I think I know, the Atomic Energy Commission was never referred to in any of the successive drafts of this bill.

Senator ANDERSON. We had testimony the other day that I thought indicated it was, and I have certainly talked to some people who thought it was.

Have you been in it from the beginning, in on the drafting?

Mr. FINAN. Yes, sir.

Senator ANDERSON. And there never was reference to cooperation with the Atomic Energy Commission in that field?

Mr. FINAN. No, sir.

Senator ANDERSON. Why not?

Mr. FINAN. It wasn't considered necessary, Senator. It is a natural relationship. It is bound to develop when the new Space Agency is created, in view of the character that, at least we hope, the program of the Atomic Energy Commission will assume in this field. It is not our normal procedure, Senator to write into legislation arrangements for the cooperation, shall we say, among executive agencies. We normally leave that to the President and, where it needs to be formalized, it is generally done in Executive orders.

Senator ANDERSON. Are there not dozens of examples where it has been written in?

Mr. FINAN. I would be hard put to cite a dozen, I think, Senator Anderson.

Senator ANDERSON. Is that right?

Mr. FINAN. Yes, sir.

Senator ANDERSON. The problem of nuclear propulsion certainly would enter in, do you not think, with space vehicles?

Mr. FINAN. Of course, we all hope it will, eventually. It is like many aspects of this space program. It is fraught with uncertainties.

Senator ANDERSON. Well, I quoted the other day from Krafft Ehricke, Convair's expert in this field and highly regarded in this country. He certainly stressed the importance of nuclear propulsion. He said:

> In regard to propulsion, it need not be stressed that space flight beyond the level of the Spirit of St. Louis type of pioneer accomplishments must have a

propulsion system of higher energy concentration available than is obtained with present chemical means. The nuclear-powered rocket engine may well mean for astronautics what the combustion engine meant for aeronautics.

That would seem to imply he thinks quite highly of it.

Mr. FINAN. I would say he undoubtedly does. I wouldn't want to pit my judgment against that of any scientist, Senator. I am not a scientist. But our understanding is that this is something that may be farther down the road a ways.

Senator ANDERSON. Is it any farther down the road than a million-pound thrust engine?

Mr. FINAN. I couldn't answer that question. You would have to get scientific advice.

Senator ANDERSON. I don't know. I have seen a mockup of a project for nuclear propulsion. I have seen much testimony that if we hope to get specific impulses running up to 400, we are going to have to make some most remarkable accomplishments in chemical propulsion. Therefore, it would seem to me that many people feel these specific impulses that run very high would have to be developed by nuclear propulsion. Was that point of view impressed upon you when you were drafting the bill or not?

Mr. FINAN. Yes, sir.

Senator ANDERSON. If it were, why not mention the one possible place for space propulsion?

Mr. FINAN. We felt that there was ample authority in the act under which the Atomic Energy Commission is conducting the project which it is hoped and expected will produce some form of nuclear propulsion. We were advised that we didn't need additional legislative authority in order to get into that field. We are already in it.

Senator ANDERSON. That is right, there is ample authority for its activity at the present time, so you wrote into this bill a provision that the space group could take it away from the atomic energy, with its approval, of course, and take it over itself.

Now, is it your vision that the space organization will take over Project Rover, Project Pluto?

Mr. FINAN. I'm not familiar with the latter project, Senator.

With respect to the first, it is not our expectation.

Senator ANDERSON. Project Rover is a nuclear propulsion project for rockets, and Project Pluto is a nuclear ram jet project, very intriguing, I think, and very important, being handled by Livermore. It would be hard if these things were taken away. I just don't understand why you would take these and turn them over to the National Advisory Committee on Space, when they are doing fairly well as it is.

Mr. STANS. May I say this about this problem? Propulsion is, of course, one of the important features of any type of space vehicle, and nuclear propulsion is one of the types that might be employed. Undoubtedly, in the early stages—and I say this, too, without being a scientist—there will be other types of propulsion. Liquid and perhaps solid fuels will be used in the earlier probes out into space. The Atomic Energy Commission, certainly——

Senator ANDERSON. May I stop you there and ask you if liquid or solid propulsion as such has entered into the problem of specific impulse?

Mr. STANS. I don't know what you mean.

Senator ANDERSON. Well, I would think it hadn't, but maybe so.

Mr. STANS. What I am saying, Senator, is that propulsion is one of the aspects of the development of this program, one of the aspects of the development of a space vehicle.

The centralization of the program in this agency makes it possible for it to secure the means of propulsion that is necessary from whatever source that is available, and certainly the Atomic Energy Commission is the only source from which atomic propulsion will be available.

So we would assume that this agency would develop the vehicle, the scientific instruments and the method by which it is to be operated, and, included in that, certainly would be consideration and use of atomic power to the extent that was feasible.

Senator ANDERSON. But you have been here long enough to know something about the ANP program, aircraft nuclear propelled, and realize it was then pretty well killed. It started again and it runs into difficulty every time. People who have tried to push it have had enormous problems because there is no group that is so drastically interested in nuclear propulsion as to push it hard, other than perhaps one committee. I wonder if you felt that with that representation of that situation here—was there any thought that by the elimination of the Atomic Energy Commission there would be no reason for any interest of the Joint Committee on Atomic Energy, officially?

Mr. STANS. All I can say, Senator, is that the Department of Defense is the only other agency mentioned in this bill, and I assume that the new Agency would be cooperating with many of the other agencies of the Government in the course of its program. There was no thought of excluding the Atomic Energy Commission or in any way discriminating against it in not mentioning it.

There is full authority for the Agency to cooperate with any other agency.

SALARIES AT "REASONABLY COMPARABLE RATES"

Senator ANDERSON. You mentioned salaries at the top of page 7, in section 6 (b) (2), at reasonably comparable rates. Do you anticipate that if they are going to be paid rates comparable to industry, these people will have their salaries supplemented, or will they get their full salaries from the Government.

Mr. STANS. I would expect them to get their full salary from the Government.

Senator ANDERSON. Is Dr. York now getting his full salary from the Government?

Mr. STANS. I'm not informed on that, sir.

Senator ANDERSON. Who would be informed?

Mr. STANS. Well, I suppose Dr. York would be the best one.

Senator ANDERSON. Well, he was up there testifying the other day, and I felt it might be a hard question to ask him. I thought this might be a good place to ask it.

ACCEPTANCE OF GIFTS

Is it your program or your plan that a person may receive so much basic salary from the Government and so much in gifts from private sources?

Mr. STANS. It hasn't been considered, to the best of my knowledge.

Senator ANDERSON. Would that be possible under this legislation or would it be desirable under the statute?

The statute, title 18, United States Code, section 1914, says:

> Whoever, being a Government official or an employee, receives any salary in connection with his services as such an official or employee from any source other than the Government of the United States, except as may be contributed out of the treasury of any State, county, or municipality—

and so forth.

If this legislation permits the organization to receive gifts, it is a little unusual in that respect.

Would it be possible for an organization to contribute a gift of $5,000 or $10,000 or $15,000 a year and ask that it be added to the salaries of one of these people in order that you might attract scientists at comparable wages?

Mr. MCCLURE. With respect to the receipt of gifts, Senator, the bill does provide in section 6 (b) (12) on page 11 that to the extent authorized by the Director—

> contributions may be made by private sources and accepted by employees receiving training in non-Federal facilities without regard to the provisions—

of that law that I believe you just read from, sir.

But this is with respect only to employees of the——

Senator ANDERSON. Well, now, wait a minute. We are not reading out of the same part. I am reading in section 6 (b) (4) on page 7 where it says:

> to accept gifts or donations of services, money, or property, real, personal, or mixed, tangible or intangible, and to make grants to further the authorized purposes of the act.

Mr. MCCLURE. Yes.

Senator ANDERSON. Suppose I represent X Co. interested in the development of astronautical spaceships, and I give them $20,000 and say you split this into two equal parts, and give each one of these people $10,000 as a gift. Would that be all right, under the law?

Mr. MCCLURE. You can make gifts under this to the Agency, but not to the employees.

Senator ANDERSON. I was very careful not to say "to the employees," because anybody that was wise enough to work this out would be too wise to violate the law.

Mr. MCCLURE. You could make gifts to the Agency.

Senator ANDERSON. And the Agency in turn to the scientists?

Mr. MCCLURE. The Agency in turn to the scientists? The Agency in turn to the employees? The purpose of this provision is to authorize the Agency to take gifts but not to make gifts.

Senator ANDERSON. I see my time has expired.

Senator JOHNSON. Senator Bridges, Senator Wiley, Senator Hickenlooper, Senator Saltonstall?

Senator SALTONSTALL. Thank you, Mr. Chairman.

Mr. Stans, may I ask just a few questions?

Mr. STANS. Yes, sir.

DECISIONS BETWEEN MILITARY AND CIVILIAN ACTIVITIES

Senator SALTONSTALL. You have amended now the policy statement in section 2 on page 2, lines 4 to 10, about which there was so much objection.

Should there not be a sentence inserted providing that the President has got to decide what activities belong to the Space Agency and what to the Defense Department?

There may be a dispute between them. Somebody has got to decide that.

Haven't you got to insert a further amendment to cover that point properly by saying the President shall decide?

I would think that that was essential.

Mr. McCLURE. Senator, as I understand it, with the amendment to the policy statement, there will still be the problem of the gray area, as the Director indicated in his testimony, sir, which the President, with the assistance of Dr. Killian and other advisers, may have to resolve.

Senator SALTONSTALL. Sure.

Well, then, a sentence to that effect should be inserted. That is all I am saying.

It seems to me your amendment is not complete in its present form.

If Senator Johnson and I disagree—if Senator Johnson says it is military and I say it is civil, we argue back and forth, and we don't get anywhere? The President has to decide it; has he not?

Mr. McCLURE. The President has to decide it, but I don't think it is necessary to have express authority in here for him to do that.

Mr. FINAN. This is part of the constitutional responsibility of the President. This is just part of his normal day-to-day work, dealing with issues of this kind that arise between agencies with closely related programs.

We would feel he would have ample responsibility and authority for doing this without specific reference to it in the bill.

TRANSFER OF PROJECTS AND/OR FUNCTIONS

Senator SALTONSTALL. In your statement on section 8, which is the section that will allow transfer of functions to the space agency, you used the word "projects."

I call to your attention that section 8 says "functions."

Do you mean "projects" or do you mean "functions"?

Mr. STANS. Well, I think very clearly it means both, in the sense that a project is a lesser part of a function.

Actually, the bill——

Senator SALTONSTALL. The bill uses "functions."

Mr. STANS. It refers to functions and then says, in parentheses:

* * * including powers, duties, activities, facilities, and parts of functions.

So, I would consider the transfer of projects would come within "activities."

Senator SALTONSTALL. I think that is so; but I think there is a great distinction between "projects" and "functions."

I would construe a function as very much more fundamental in a department than a project.

Mr. STANS. It is a broader term, certainly.

Senator SALTONSTALL. Now, if you are going to transfer functions—you and I discussed this privately the other day—shouldn't you at least notify Congress that you are going to do it?

If it is unconstitutional—as you pointed out the other day in your private conversation with me—to provide for prior approval by Con-

gress, Congress certainly should be consulted or notified in some way or other.

Mr. STANS. I don't think there would be any serious objection to a provision requiring that Congress be informed of these transfers of functions, so long as it was within the constitutional limitation; but I think there is precedent, although I can't cite the precedent offhand, for this type fo language.

The Airways Modernization Board, I'm told, has this precise language.

Senator SALTONSTALL. This goes a little further. It seems to me that transfer of functions to the Space Agency are more important in broad national policy questions than transfers to the Airways Modernization Board. I don't want to belabor that point because I have several other questions, but it would seem to me that Congress should be notified if a function was going to be given up in the space research and development area because that involves substantial appropriations and it involves basic policies that the Congress had debated when it put particular functions in particular departments.

Mr. STANS. I would assume that practically all of the transfers under this section would take place rather promptly.

LETTING OF CONTRACTS

Senator SALTONSTALL. Now, you have stated very positively in your prepared talk that you prefer a single official to a small commission. Senator Anderson has taken that up with you. Shouldn't the Board have veto power, or confirmatory power on certain major capital undertakings? For instance, this is an agency that will make contracts for construction. Here we have a single man who might make a contract for a $500 million project. These projects will likely run into awfully big money. Shouldn't the Board on capital undertakings, say contracts of over X dollars, have a confirmatory power even though it has only a consultative role on other things?

Mr. STANS. Of course, before the head of an agency could commit anything of the size of money you mention, hundreds of millions of dollars, it would have to pass the Bureau of the Budget and the President and the Appropriations Committees of Congress, and I would assume there would be pretty careful scrutiny along the course of any proposal of that type.

The basic proposition is whether or not an agency operates better with a single head who is accountable to the President and to the Congress for his actions or whether you can have a large group of people telling the Director what to do. It just doesn't seem that a group of unpaid people meeting at relatively infrequent intervals can assume the function effectively of directing the activities of an agency of this size and power.

SALARY MAXIMUM

Senator SALTONSTALL. Now, may I ask you this question? Do I understand from your statement that while there may be salaries commensurate with private employment in this Agency, that no one salary should be more than $22,500, which is the salary of the Director? Is that what you said?

Mr. STANS. I would think that would be the only way you could effectively administer this activity.

Senator SALTONSTALL. I think the Civil Service Commission should discuss that question with us a little bit more.

INTERNATIONAL COOPERATION AND FOREIGN CONTRACTS

Now, you have offered an amendment relating to international cooperation. "The agency may engage in a program of international cooperation," and so forth, "pursuant to agreements negotiated by the Department of State or approved by that Department". At the present time the military I know are cooperating in research projects in Belgium and France and other places. They are placing contracts. Certainly they can't be getting the approval of the State Department for those research agreements to take place over there. This amendment as now drafted might have the Department of State involved in a very technical space research agreement that we might want to make, for instance, with England or France or some other country.

Mr. STANS. I think, Senator, there is a confusion of terms. This provision relates to international cooperation.

Senator SALTONSTALL. That is right.

Mr. STANS. This term means activity between nations, and in that case the State Department would be brought in. I would think that that would not preclude the Department of Defense giving a contract to some contractor in a foreign country.

Senator SALTONSTALL. Well, perhaps you clarify that by your interpretation. I might not interpret it quite as you have. It would seem to me that the language might be thought to apply to any agreement that was made by the Space Agency or by the Department of Defense.

Mr. STANS. I don't think it is so intended.

Senator SALTONSTALL. I agree it may not be so intended.

ACCEPTANCE OF GIFTS

Now, we have talked before about outside gifts. Have you any precedent to show that any agency of Government can receive gifts, we will say, from some foundation or some private individual and use them for Government activities?

Mr. STANS. I understand, Senator, that this is language equivalent to provisions in the legislation relating to the National Science Foundation and the National Bureau of Standards. But I will say this, and I am authorized to say this, that if this provision is objectionable to Congress, the administration isn't going to be greatly concerned about its deletion. It was thought this would be a helpful provision in the sense that some item of research, some piece of research equipment or other, might be received from a private contractor for the use of the Agency and it might be helpful to have that provision in the bill, but if there is objection to it, it is not basic to the purposes of the bill.

OBLIGATED SERVICE AFTER TRAINING

Senator SALTONSTALL. Now, as to the period of obligated service after a training period—I also discussed this in private conversations with you—the ratio is 1 to 3, to put it very quickly because my time

is running out. In other words, we will say an employee goes out for 6 months. He will only have to work for 18 months when he comes back although we may have given him a very expensive training. Shouldn't the period of obligated service be increased to at least six times the training period, so that if he went for 3 months, he would have to work thereafter for 18 months? If he went for 6 months, he would have to work for 36 months or 3 years?

Mr. STANS. I will ask Mr. Finan to answer to that since he is familiar with the evolution of that paragraph.

Mr. FINAN. Senator, that, of course, is a policy issue. Someone—in this case, the Congress—has to decide what is an appropriate minimum period of time for an employee to work after having received a given amount of training. We used as our guide in the preparation of this language the text of the general training bill which would give this kind of authority throughout the Government and followed it, I believe, precisely. That is the bill which has passed the Senate and is now pending in the House.

Senator SALTONSTALL. Mr. Chairman, my time has expired but I have one more question that could be answered very quickly.

Senator JOHNSON. Proceed, sir.

Senator SALTONSTALL. Thank you, sir.

COOPERATION FROM OTHER AGENCIES

Mr. Stans, do you feel it would be desirable for the Director of the Space Agency to have authority to call on all other Government departments and agencies for information developed by them with respect to space exploration research? Now, that would be an extension of your section 8, as I see it.

Mr. STANS. I think it would be quite desirable for the agency to call on any other agency that had information in this field.

Senator SALTONSTALL. It would be helpful to have that specifically included in the language of the act in some way, would it not, even though it might be interpreted from the present language.

Mr. STANS. I think the act can be interpreted to include that. There is no objection to adding additional words that say it more precisely if you think it is necessary.

Senator SALTONSTALL. Thank you, Mr. Stans. Thank you, Mr. Chairman.

Senator JOHNSON. Thank you, Senator Saltonstall.

Senator Symington?

ADMINISTRATIVE ORGANIZATION OF NEW AGENCY

Senator SYMINGTON. Mr. Director, are you acquainted with the President's desire to reorganize the Pentagon?

Mr. STANS. I am acquainted with his desire, yes sir.

Senator SYMINGTON. Are you acquainted with the bill itself?

Mr. STANS. Not a great deal. Again, Senator, that bill was evolved prior to the time I became Director of the Bureau of the Budget.

Senator SYMINGTON. What were you doing prior to that time?

Mr. STANS. I was Deputy Director of the Bureau and active in other matters. The last Director participated in these reorganization plans.

Senator SYMINGTON. Have you anybody here who knows that bill?

Mr. FINAN. I am generally familiar with it, Senator Symington.

Senator SYMINGTON. Well, as I understand it, the purpose of the bill is to eliminate duplication and waste and consolidate administrative authority with administrative responsibility. Is that correct?

Mr. FINAN. That is correct, sir.

Senator SYMINGTON. If we were going to start a new Pentagon structure today, do you think we would start it with 5 Air Forces and 4 services?

Mr. FINAN. I would hope not, sir.

Senator SYMINGTON. We had an agency once called the Surplus Property Board. It got beset with problems, so they appointed an Administrator. Do you remember that?

Mr. FINAN. Yes, sir. I recall that rather distinctly.

Senator SYMINGTON. Then we had a board running that was called the RFC. We decided we had better have an Administrator handle that instead of a board. Is that right?

Mr. FINAN. I recall that one even more distinctly, yes, sir.

Senator SYMINGTON. And the purpose of this bill is not to have 17 people, each with some ax to grind, wandering around to have some influence on a decision that has to be made quickly, based on the testimony we have about space problems. Do you agree with that?

Mr. FINAN. Yes, sir.

Senator SYMINGTON. And after all, if there is a crook in any department, or inefficiency, that is fundamentally the responsibility of the Chief Executive of the United States, is it not?

Mr. FINAN. Yes, sir.

Senator SYMINGTON. And if he has to delegate his authority, based on common business practice and commonsense, it is better for him to delegate it to an individual than it is to a board meeting 3 or 4 times a year. Is that correct?

Mr. FINAN. Yes, sir.

Senator SYMINGTON. And the law prescribes, as I read it, that on matters of major policy the Director shall consult with these 17 people. That is right, is it not?

Mr. FINAN. That is correct.

Senator SYMINGTON. And if one of them had access to the President of the United States, one of the members of the Board, and didn't agree with the Director's decision, he could appeal to the President himself, could he not, and say he thought the Director's act was wrong?

Mr. FINAN. If the President would accept such an arrangement, yes, sir.

Senator SYMINGTON. Well, you might consider the fact the President wouldn't want to put anybody in a position of such responsibility and then be unwilling to speak to such person, if the latter had something to bring to his attention.

Mr. FINAN. I would think that would be a fair assumption, Senator.

Senator SYMINGTON. So all you are doing here is trying to start out with something which would eliminate the type and character of mess we have in the Pentagon today, from the standpoint of organization and functioning. Is that a fair statement?

Mr. FINAN. Well, I would prefer not to compare the problem of the Space Agency with the problem of the Pentagon. We are trying to set up a straight line operation here, Senator.

Senator SYMINGTON. Let us put it this way. What you want to do in this field, instead of having a lot of autonomous setups, as was reported by the President in a letter to his friends in the press yesterday, telling his friends about the way the Pentagon was set up, a lot of independent organizations instead of one as in a business, each department reporting separately to the board of directors. What you want to do now is establish an organization going into the space problem on the basis of those sound business principles recommended in that letter from the President. Is that right?

Mr. FINAN. Exactly, sir.

Senator SYMINGTON. I think you have a good bill based on these recent changes as a result of these hearings. There may be some additional changes that should be made but I think the bill is well drawn.

Thank you.

Mr. FINAN. Thank you, Senator.

Senator JOHNSON. Does that conclude your questions, Senator Symington?

Senator SYMINGTON. Yes, thank you, Mr. Chairman.

Senator JOHNSON. Senator Bricker?

CHARACTER OF THE NEW AGENCY

Senator BRICKER. Mr. Chairman—Mr. Stans, I note that you have suggested certain amendments here. I have been trying to determine in my own mind just the character of this new Agency. It is essentially an executive agency, is it not, not an administrative, but an executive agency, an arm of the Presidency?

Mr. STANS. It is an executive and operating agency, yes.

Senator BRICKER. And not primarily responsible to the Congress but responsible to the President?

Mr. STANS. Yes, sir.

Senator BRICKER. And it takes over sort of lock, stock, and barrel, the functions of the NACA?

Mr. STANS. It does, yes.

Senator BRICKER. That agency is a research agency and advisory commission?

Mr. STANS. It is a research agency, yes, sir, functioning under an advisory committee and a director appointed by the committee.

Senator BRICKER. And that function will be continued in this organization?

Mr. STANS. All of the functions of the NACA will be continued in this new organization.

RELATIONSHIP TO OTHER AGENCIES

Senator BRICKER. Then there will be additional functions taken over by this new administration or new agency as you outline the policy declaration in section 2 on page 2, what some of those functions are, at least the purposes of the agency. Would you have any objections from the administration point of view to including in there cooperation with the Atomic Energy Commission the same as with the Department of Defense?

Mr. STANS. I think the only objection is the practical one that if you named the Atomic Energy Commission, the question would arise as to whether you should name anyone else.

Senator BRICKER. Who? What other department?

Mr. STANS. National Science Foundation, for example.

Senator BRICKER. Would they have a direct relationship, do you think, as would the Atomic Energy Commission in the development of propulsion?

Mr. STANS. Yes. They would have a definite interest in this area, and so would the Bureau of Standards.

Senator BRICKER. Would there be any real objection to naming them, then?

Mr. STANS. I think there would be no objection to saying that the Agency would cooperate with each of them in their particular fields, although I think the preference would be to leave them out entirely.

Senator BRICKER. Why do you pick out, then, the Department of Defense rather than these others which are also vitally interested?

Mr. STANS. Well, because Defense has a direct competing interest in some areas of the overall aspects of the program. There are some things that will go into space, as completed vehicles or devices, that will be military.

Senator BRICKER. Do you think that this Agency is authorized in any way to take those functions away from the Department of Defense?

Mr. STANS. It is not; except, Senator, to the extent that they are not qualified for retention in the Department of Defense within the language of the policy directive.

Senator BRICKER. Of course, the final determination in that would be the Department of Defense because they have the veto.

Mr. STANS. Well, it would be a veto except that in the case of the difference of opinion between the two agencies, it would be the President who will decide.

Senator BRICKER. I think the bill says with the consent, does it not, of the President?

Mr. STANS. Yes, sir; it does.

Senator BRICKER. Would the same relationship prevail with regard to the other three departments you have mentioned?

Mr. STANS. Yes, of course.

Senator BRICKER. And would you have any objection to naming the Atomic Energy Commission in section 4, subparagraph 1 under a?

Mr. STANS. I am going to ask the draftsman of the bill to comment on that because I know the point was considered at the time the bill was drawn. Mr. Finan.

Mr. FINAN. Senator, one of the problems we have here is the extent to which other agencies of Government currently have an interest in the space program, and as time goes on, additional agencies may have an increasing interest or, let us say, completely new interests. And the problem here, in mentioning agencies, is where do you stop. There would be a presumption if you name 3 or 4 agencies and left out a fifth that there was to be no cooperation with that fifth agency, or that there was to be less cooperation or less in the way of an effective working relationship.

While this is a new and an exotic program, generally speaking, in terms of the organizational problems it generates, it is a familiar

problem. And the Congress, as a matter of longstanding policy, has refrained from writing into law a lot of detail having to do with the interrelationships among the executive agencies, and the extent to which they should or should not work together.

Our experience has been that where agencies have interrelated programs that they can and do work together; and to the extent problems develop, they are usually of such a complicated character that they require at least for awhile almost day-to-day attention of the President. Only the Chief Executive can correctly straighten them out. In other words, we do not feel that the Atomic Energy Commission or the National Science Foundation or any of these other agencies are in any way going to suffer or be left out, or their capacity or their programs ignored in this space program, by reason of there being no reference to them in the bill.

Senator BRICKER. I would certainly hope not, but wouldn't that same logic to which you have alluded here apply to naming the Department of Defense and not naming the others?

Mr. FINAN. The big difference is that the Department of Defense is and will be operating in outer space in connection with weapons systems, in military operations, and as far ahead as we can see at the moment, there is no other agency in view that is apt to be operating space vehicles or other objects in space. That is the unique characteristic of the Department of Defense here.

PRESIDENTIAL AUTHORITY IN INTERNATIONAL AGREEMENTS

Senator BRICKER. Now, coming, Mr. Stans, to your amendment in regard to international cooperation, I would object personally very strenuously to having any direct authority given to the State Department. The President speaks for the United States in international affairs. The State Department is only an agency of the Presidency in international relationships. I think that you would be on much sounder ground to name the President there rather than to give the power to negotiate agreements to the State Department itself or approved by that Department simply because the President is the spokesman for the United States in foreign affairs and the State Department is only an agency of the Presidency to carry out his program.

Mr. STANS. Well, Senator, I am assuming that the Department of State would proceed under its proper authority in any negotiations or agreements of any kind and if any questions were such as to require action by the President, he would be brought in. I am not assuming that this gives the Department of State any more authority than it now has.

Senator BRICKER. It certainly does. It gives the State Department the authority and with the approval of Congress to enter into international executive agreements, and the President is the only one now that has that authority and the only one in my judgment that ought to have that authority.

Mr. STANS. I don't think that was a question, Senator. Do you want me to speak to that?

Senator BRICKER. I want to know why you put the power in the State Department rather than the President who has the authority, if anyone has. The authority ought to be limited to him, rather

than the Congress giving to the State Department the authority to enter into international agreements, which this does.

Mr. STANS. Well, all I can say, Senator, is to repeat what I said before, that I assume that the State Department would operate within its existing authority and within its existing relationship with the President.

Senator BRICKER. But isn't the issue about Congress giving the authority to the State Department to enter into executive agreement with other countries of the world? That authority is now and ought to continue to be limited to the President of the United States.

Mr. FINAN. Senator, if I may comment on that, I understand this language to refer to the negotiation.

Senator BRICKER. Pursuant to agreement by the State Department and approved by that Department.

Mr. FINAN. It says negotiated by the Department or approved by the Department; yes, sir.

Senator BRICKER. Who enters into the agreement?

Mr. FINAN. I would assume only the President under the Constitution has the authority to enter into these agreements.

Senator BRICKER. You ought to say so, then.

Mr. FINAN. This language as we understand it runs to that.

Senator BRICKER. Let us not change the constitutional authority by a direct grant of the power to the State Department.

Mr. STANS. There is no intention of changing the constitutional authority.

Senator BRICKER. I think it could be better worded than it is.

Just another question or two.

Senator JOHNSON. In that connection, Senator Bricker, did you ask him to submit amending language?

Senator BRICKER. I think the committee can draft the language.

Just what can this new Agency do—just one question and answer, please.

QUESTION OF NECESSITY FOR NEW AGENCY

Just what can this Agency do and what should it do that cannot be done at the present time by the NACA and by the Atomic Energy Commission and by the Department of Defense, the National Science Foundation, and other established departments?

Mr. STANS. I think——

Senator BRICKER. Is it just simply for administrative purposes to pull it all together or is there some new function that is now not given to any department of the Government?

Mr. STANS. I think, Senator, that is answered in my opening statement, but I will be glad to refer to it again. The purpose of this is to change the fundamental organization of NACA, its name, its powers and its authority in a number of areas in order for it to be able to take on this major responsibility under a structure in which it can operate most effectively.

Senator BRICKER. What are those functions that are not now lodged anywhere?

Mr. STANS. Well, one of the functions that the Agency does not now have is the authority to contract in a proportion necessary for this program. Its contracting authority is limited to $500,000. Even the name of the Agency has outlived its——

Senator Bricker. I appreciate that. That needs to be changed as its functions change; but what I am getting at is: what new functions are given to this Agency that are not now lodged anywhere in the Government?

Mr. Stans. The function of coordinating the space program of the Government.

Senator Bricker. Well, that was my premise to the question. Is it anything more than a coordinating authority with all of the others drawn into it?

Mr. Stans. The coordinating authority with the implementation that is necessary, yes.

Senator Bricker. That is all.

Senator Johnson. Thank you.

Counsel?

RESEARCH, DEVELOPMENT, AND OPERATION

Mr. Vance. Mr. Stans, there are some ambiguities in my mind with respect to the nature of this organization; namely, was it intended to be primarily a research organization—was it intended to engage in operations for research purposes only—is it actually to produce and operate aeronautical and space vehicles?

Now, the language I think is ambiguous on that and I would like to ask you what the intent is.

Mr. Stans. The intent is that it does all of the things that you have quoted, to engage in a program of research, develop that kind of a program, conduct scientific studies in research, to actually develop, test, launch, and operate vehicles in space, and to arrange generally for cooperation with the scientific community and in the Government in that general area.

Mr. Vance. I see. It is intended to cover all three of those aspects.

Mr. Stans. Yes.

DEFINITION OF "SCIENTIFIC COMMUNITY"

Mr. Vance. Now, next, with respect to section 6 (a) (4) of the bill, if you have it before you, that provides that the agency shall arrange for participation by the scientific community in planning scientific measurements and observations to be made through the use of aeronautical and space vehicles, and conduct or arrange for the conduct of such measurements and observations, and provide, as appropriate, dissemination for the data collected.

I would like to ask, first, what is meant by the term "scientific community" as used in that section?

Mr. Finan. With the chairman's permission, I would like to comment on that. That is a shorthand way of saying whatever scientific talent and know-how is available, in both the Government and in private life, that has relevance for this space program.

Mr. Vance. Does it include foreign scientists?

Mr. Finan. I beg your pardon?

Mr. Vance. Does it include foreign scientists or is it limited to the United States?

Mr. Finan. It could include developments that came about by reason of research by foreigners, yes.

Mr. Vance. Is the intent to include foreign scientists as well?

Mr. FINAN. To include them in just what manner? Do you mean to employ foreign scientists in the agency?

Mr. VANCE. Correct.

Mr. FINAN. If that is your question, there is another provision in the bill that relates to that. This provision does not deal directly with that, but elsewhere we do have in this bill the authority for the employment of aliens; yes, sir.

Mr. VANCE. Let me approach it this way. What is the purpose of this section? This is subsection 4 of section 6.

Mr. FINAN. The purpose of this section, as is true of the preceding section, is to set out in law substantially the full scope of the type of program that the Congress is authorizing this new agency to conduct. And this particular section runs to arranging for the participation of the scientific community in planning scientific measurements, observations, and so on, just as it is spelled out here. In other words, we will endeavor to get the advice of expert scientists and others in connection with formulating this totally new and unprecedented program. But it means to get their advice and help and not to turn any vestige of authority or direct governmental responsibility over to them.

EMPLOYMENT OF ALIEN SCIENTISTS

Mr. VANCE. Now, you mentioned that there was another section of the bill which was related to contracts with foreign scientists. Could you point to that, please?

Mr. FINAN. In section 6 (b) (9) on page 9, the subsection beginning on line 7 which reads:

> When determined by the Director to be necessary and subject to such security investigations as he may determine to be appropriate, to employ aliens without regard to statutory provisions prohibiting payment of compensation to aliens.

That is the direct purpose of that section.

Mr. VANCE. I see. Thank you.

Senator SALTONSTALL. Would you yield on that point, if you are going on to another point?

What I would like to ask is this. If you have a need for this section which includes the words "scientific community," why wouldn't it be well to limit that to the United States and then cover the question of foreign scientists in the amendment that you have offered on international cooperation in such form as the committee might rewrite it?

Mr. FINAN. Senator, we would not like to see this section 6 (a) (4) on page 6 circumscribed in that manner. This is simply a section which will authorize the Agency to arrange to get advice and assistance from eminent scientists wherever they may be on the basis of which the Agency itself will then formulate its own program. This is a section that was developed, as I believe I mentioned earlier, in recognition of the new and to a considerable degree unpredictable character of this space program.

Senator SALTONSTALL. I think the section is good, but I thought you were working two things in together and perhaps it isn't quite clear as they are now.

Mr. FINAN. Well, we think they are clear in this respect, that section 6 (a) (4) on page 6 grants no authority to employ anyone. It has nothing to do with the employment of persons as Government officers or employees. The other subsection that I referred to on page

9, section 6 (b) (9), refers only to the waiver of certain statutes which prohibit the payment of compensation to aliens. As we see them, they are clearly separable and serve distinct purposes.

Senator SALTONSTALL. Thank you.

COMPOSITION OF THE SPACE BOARD

Mr. VANCE. Turning to the amendments which have been suggested today, I note that in section 4 (a) (1) in the first sentence the words "no more than eight" are to be removed and the word "nine" is to be substituted, so that the sentence will read:

> Nine of the members of the Board shall be designated from appropriate departments or agencies of the Government of the United States.

Could you tell us the reason for that change?

Mr. STANS. The reason is a very simple one. It would seem to be that there was a great deal of suspicion or misunderstanding of the figure "8", which was inserted only to bring about a balance as closely as possible between those employed in the Government and those employed outside. The balance can be achieved as closely by reversing the provision and making it read "nine" in the Government and "eight" outside. There was nothing sinister in the suggestion of 8, and to avoid any further issue, we suggest it be changed to 9.

Senator JOHNSON. It does make it a little more understandable. After you got a second run at it, you made it a little clearer at least to some dense people.

Mr. STANS. If it does make it clearer, I am very happy to have made the suggestion.

Senator JOHNSON. Doesn't it make it clearer to you?

Mr. STANS. No.

Senator JOHNSON. Under your former language did you have eight people?

Mr. STANS. No. The whole point of the language was flexibility. It might well be, Senator, for example, that instead of 17 members, and you will notice that that was originally stated at not to exceed 17, that some President might decide to make it only 11, in which case he could get a majority by appointing 6. So that the whole paragraph, the whole section was written with flexibility in mind, and since that seems to have created misunderstandings and some distrust, we suggested it be clarified by making it 17 in total, 9 within the Government.

Senator JOHNSON. I think that is quite an improvement. I'm sorry you don't.

Mr. VANCE. I note in the same subsection 1 of section 4, in line 23, the word "one" has been changed to read "three". Can you tell us the reason for that change?

Mr. STANS. Well, really for the same reason. The language was "at least one," to be sure that the Department of Defense was included, but there was no limitation in it. It was left flexibly to the President to appoint as many as he wanted from the Department of Defense, but at least one. Now, in the face of all of the questions and objections that have been raised, the suggestion is made that it be changed to three.

Mr. VANCE. And this was put in at the suggestion of the Department of Defense; is that correct?

Mr. STANS. It was put in as a result—yes, of recommendations of the Department of Defense and consideration by the administration.

PERIOD OF OBLIGATED SERVICE AFTER TRAINING

Mr. VANCE. Now, either Mr. Stans of Mr. Finan, in section 6 (b) (12), on page 10, in line 24, it reads as follows, in part:

> For a period equal to three times the length of any time off with pay granted such employee without charge to annual leave—

And so forth. Can you tell us how you arrived at the figure "three times"?

Mr. FINAN. I had a discussion earlier with Senator Saltonstall on that same point. The ratio of length of service to length of training received is strictly a matter of policy, and one for the Congress to determine. This particular section of this particular bill was simply lifted from the general training bill that would grant this kind of authority broadly within the executive branch and which has already passed the Senate, and as a matter of convenience and since hearings had already been held on the other bill, and it was clearly understood, we simply used substantially the same or I believe identical language here in this particular section.

Mr. VANCE. Thank you.

QUESTION OF CONGRESSIONAL APPROVAL FOR TRANSFERS

Now, I direct your attention to section 8 appearing on page 15. I would like to ask whether or not any consideration was given in the drafting of this section to including a sentence requiring that the action provided for therein be done with the concurrence of the Congress in any way?

Mr. FINAN. This section again is modeled after a section which was incorporated in the Airways Modernization Act which was passed by the Congress last year, and is designed to serve much the same purpose.

A question was raised earlier of a somewhat similar type and that is: Would we have any objection to a provision in here that called for the notification or advice to Congress about action taken under this section? To that the answer was: "We would have no objection to it."

Mr. VANCE. Your answer to my question is: "There was no consideration given to such a provision as I mentioned in my question."

Mr. FINAN. Well, it is rather hard to say what matters were and were not given consideration in the drafting of this rather elaborate and technical bill. But again, because we had a model which had been found acceptable to the President and the Congress to deal with a comparable situation, we simply used as a model the comparable provision in the Airways Modernization Act.

Mr. VANCE. Thank you. Mr. Chairman, I have no further questions.

Senator BRICKER. Mr. Chairman, could I ask a question?

Senator JOHNSON. Senator Bricker.

RELATIVE MERITS OF SINGLE VERSUS MULTIHEADED ADMINISTRATION

Senator BRICKER. I think the most serious long-range problem of Congress in reference to this bill is the determination of the nature, of the character of the Agency. Now, Mr. Stans testified a while ago that you patterned this after the general practice in administrative agencies, but there is a completely different character between this kind of an agency and the Atomic Energy Commission, for instance, which is the most nearly comparable activity that I can think of which the Congress has authorized. There, we did elect a board or authorized a board responsible to the Congress, reporting continually to the Congress, and here you have a different character of an agency, entirely appointed by the President, of course, with the confirmation of the Senate, but it is a single-head agency with only an advisory committee, and it is responsible, or the Agency head is responsible, to the President, which converts it into an executive arm rather than a legislative arm, in my judgment. Is that your interpretation of the bill?

Mr. FINAN. Well, to begin with, Senator, we do not see how it would be possible under our Constitution to establish this Agency as anything except an organ of the executive branch. It is carrying out purely executive functions. There is nothing here that has any flavor of legislation.

Now, insofar as the Atomic Energy Commission is concerned, we would see the situation with respect to the space program as being very dramatically different from the situation that confronted this country and the Congress toward the close of World War II when the problem came up of how to organize for the conduct of the atomic-energy programs in peacetime. There, you had a program which had to be conducted in the interests of national security under a total cloak of secrecy for a very considerable period of time. There was going to be no basis for the normal democratic processes to work in connection with that program for an unforeseeable period of time.

The one thing that was known was that we had developed the most terrible weapon of war that anybody had ever imagined. Whoever had that program turned over to them, therefore, was going to be operating out of sight of the public, so to speak, even out of sight of the majority of the Members of the Congress, and was going to be dealing with a death-dealing instrument of perfectly terrifying proportions. And it was against that background that the Congress felt that, under all of the circumstances, no one man under the President should be given this kind of responsibility and this kind of power. And they deliberately put it in a multiheaded agency where the members have fixed, overlapping terms in order to prevent that sort of situation.

Now, in contrast, our space program is one that, as far as the civil side is concerned, is to be conducted in the broad light of day, with only such secrecy involved as may be necessary while we are using military rocketry in order to launch these vehicles—where its purposes are the advancement of science on a broad front and where its purposes cannot be served unless the results of these experiments and these explorations are made fully available to the scientific community to capitalize on.

So, we would say that the situation here is quite different, and it is one in which the well-established pattern of the executive branch

organization is much more suitable and much more applicable than was the case when we were originally establishing the atomic-energy program and which led to the conclusion that a multiheaded agency seemed to be the best solution to an admittedly very difficult problem.

Senator BRICKER. Of course, the atomic-energy concept had worked pretty well in the field. I think they have done a remarkably constructive and fine job. After all, it is just a balancing of efficiency of 1 head who could make decisions rapidly, carry them out, getting the checks that come from, say, a 5-man or a 3-man board.

Mr. FINAN. Well, we believe that the space program is one in which the normal machinery of Government ought to be allowed to work, which is to place one man in the position where the President and the Congress can clearly and without any doubt hold him fully responsible, not only for such successes as his Agency might have, but for any failures which may occur.

Senator BRICKER. I don't see how——

Mr. FINAN. That cannot be done under a multiheaded arrangement.

Senator BRICKER. Why not?

Mr. FINAN. Because you can't fix responsibility that clearly. You have a group responsibility.

Senator BRICKER. I can't conceive of why the secrecy in the atomic-energy field would make any difference, as far as the character and the nature of the administration itself was concerned. If one is sufficient, the other would be.

Mr. FINAN. Well, sir, my impression—the history of the Atomic Energy Act was one in which other considerations were thought to outweigh the question of efficiency. The traditional American way of organizing any large operating enterprise, be it public or private, is to head it up with a single executive. It has been a tradition in our country since the Constitution was written.

The debates, you will recall, prior to the adoption of the Constitution, went deeply into this question of whether the President should be one man or a group. And we have learned to operate our major business enterprises successfully and our major governmental enterprises successfully under the single-executive arrangement.

Senator BRICKER. Wouldn't the same logic apply to all the other administrative agencies of the Government, then?

Mr. FINAN. I would say that in every case with which I am familiar—and I think I am familiar with the majority of them—the decision was made to put a board or a commission at the head of an agency on the basis of considerations other than the efficient operation of the agency. For one reason or another, multijudgments were wanted. In our regulatory commissions, a judicial approach toward the decisionmaking process, where private rights are involved, is sought. Another result you can get with it is by making it bipartisan. But these other benefits are benefits which do not run to the question of operating efficiency, but to other things.

Senator BRICKER. You have attempted to get that through your Advisory Board here, with judicial policy, regulation, the overall conduct determined by the multiple agency itself?

Mr. FINAN. In this case, we are providing this Advisory Board for a little bit different purpose. It is, in part, to continue the NACA arrangements which have worked so well, and we must bear in mind

that this new Agency is going to continue to conduct a very major program in the aeronautics field, largely on behalf of the military.

Currently, the expenditures on that program are exceeding $100 million a year, and it is expected that those will continue. We are very concerned about doing anything here that could disrupt the unusually effective working relationships between the Department of Defense and this Agency in the field of aeronautical research.

Senator BRICKER. Well, then, this Agency really creates something comparable to a Cabinet post, rather than to one of the administrative agencies responsible to Congress?

Mr. FINAN. Well, we have quite a number of so-called independent agencies, Senator, which are headed by single executives. The Housing and Home Finance Agency is a good example. So is the Veterans' Administration. Small Business Administration is another. Prior to its conversion into an executive department, the old Federal Security Agency also had a single administrator.

Senator BRICKER. In those cases, though, the law pretty well laid down the formula under which they would carry on their functions, I think in a little bit more detail, a great deal more detail, than this bill.

Mr. FINAN. That may be true. It is a little hard to generalize about that.

Senator BRICKER. I know you can't generalize.

Mr. FINAN. But I think we all need to bear in mind that with the enactment of this legislation, this will not be the finish of the concern of the Congress with this program.

Senator BRICKER. No; we will be around here a long time.

Mr. FINAN. As events unfold, it is to be expected we will develop quite a body of law surrounding this program, I would assume.

Senator BRICKER. Those are the only factors then that weighed in your making this a single-man agency rather than a commission form?

Mr. FINAN. They were the only ones, but that is not to minimize the importance that we attach to them, Senator.

Senator BRICKER. I do not argue with you on that at all. It may be exactly the right thing to do. I am just trying to get the logic back of choosing one course instead of the other.

Mr. FINAN. Yes, sir.

Senator BRICKER. Thank you, Mr. Chairman.

QUICKER SUCCESS OF SPACE PROGRAM WITH NEW AGENCY

Senator JOHNSON. Mr. Finan, in your opinion, will this bill get us into outer space more rapidly and more efficiently than our present setup?

Mr. FINAN. Well, without this bill, Senator, we are not going to be getting into outer space with a civilian program of any significance. The only civilian space program that currently is authorized is this temporary arrangement under the Advanced Research Projects Agency of the Department of Defense which terminates early next year.

Senator JOHNSON. Your answer, then, would be "Yes"?

Mr. FINAN. Yes, sir.

Senator JOHNSON. I want to commend you on the quality and the candor of your response to all the questions that have been asked you. Unless counsel has some more questions, you are excused.

Thank you very much, Mr. Director.

Mr. Ellsworth of the Civil Service Commission. Will you please come forward.

Our final witness this afternoon is Commissioner Harris Ellsworth of the Civil Service Commission.

Mr. Ellsworth, the measure before us presents some problems involving the classification system of our Government. We have called you to shed some light on these problems.

As background for your testimony, I am inserting in the record your biography.

(The biography referred to is as follows:)

BIOGRAPHY OF HARRIS ELLSWORTH, CHAIRMAN, UNITED STATES CIVIL SERVICE COMMISSION

Mr. Harris Ellsworth was born at Hoquiam, Wash., September 17, 1899. He attended public and high schools in Oregon and was graduated in journalism from University of Oregon in 1922.

Mr. Ellsworth worked on Oregon newspapers, in lumbering industry, as manager of Oregon Newspaper Publishers Association, and associate professor in journalism at the University of Oregon, and as manager of a lumber industry publication; has been part owner of Roseburg News-Review since 1929; served as president of Oregon Newspaper Publishers Association, Oregon Press Conference, and University of Oregon Alumni Association. He was appointed State senator near the end of the 1941 session of the Oregon Legislature; elected to the 78th Congress from the 4th Congressional District of Oregon and served continuously for seven terms until the end of the 84th Congress.

Mr. Ellsworth was a member of the congressional group which met with delegates of the Council of Europe at Strasbourg in 1951, was a member of the American congressional delegation to the NATO Parliamentary Conference in Paris, November 1956; He was appointed Chairman, United States Civil Service Commission, in 1957.

Senator JOHNSON. I desire to personally welcome you and the committee is ready for any statement you may care to make. I recall with a great deal of pleasure our service together in the other body, and I am delighted that you have seen fit to continue with your Government service.

STATEMENT OF HARRIS ELLSWORTH, CHAIRMAN, UNITED STATES CIVIL SERVICE COMMISSION; ACCOMPANIED BY WARREN B. IRONS, EXECUTIVE DIRECTOR, UNITED STATES CIVIL SERVICE COMMISSION

Mr. ELLSWORTH. Thank you very much, Senator Johnson.

Mr. Chairman and members of the committee, I do have a statement which is a very short one, and I will be glad to read it.

I appreciate the opportunity to comment on S. 3609 which would establish the National Aeronautics and Space Agency. My letter of May 5, 1958, to Chairman Johnson reported the Commission's position favoring enactment of the personnel provisions of this bill.

My special concern, and I am sure your interest in my testimony, bears on section 6 (b) (2) of the bill which exempts the new Agency from the Classification Act of 1949 and the Federal Employees Pay Act. This section authorizes the proposed NASA, subject to such regulations as the President may prescribe—and I quote from the bill—to—

fix and adjust, as nearly as consistent with the public interest and on the basis of equal pay for equal work at rates which are reasonably comparable with prevailing rates paid by non-Federal employers for similar work, compensation of such officers and employees as may be necessary to carry out the provisions of this Act.

I am sure that you have already been presented with ample evidence of the special and critical necessity for this most important activity to attract and retain the country's most outstanding personnel in order to continue and expand the research activity in this vital area.

When considering the personnel problems involved in staffing the Agency which S. 3609 would create, two important and compelling facts must be borne in mind. First, this Agency occupies a position of the highest possible importance in Government operations and will deal with some problems the solution of which lie as yet outside the knowledge and experience of man.

Second, there is a decided element of urgency in the mission of this proposed Agency. It must function with speed, accuracy, and efficiency, and must be as free from staffing problems and personnel difficulties as possible. In view of these facts the NASA must be able to adjust promptly and adequately to competitive salary rates in order to maintain an adequate and qualified work force for the support of this important mission.

The proposed pay provisions in this bill are intended to meet this need for timely and adequate pay adjustments. These provisions include at least two desirable restrictions. One calls for a welding of the principle of equal pay for equal work with the principle of reasonable comparability with prevailing pay. This will effectively guard internal job and pay alinement against undesirable dislocations.

The other requires that this authority be exercised under regulations prescribed by the President. This will assure that this authority will be exercised subject to externally imposed standards, and I believe we may presume that such standards will require the administration of this authority to be geared properly with relevant existing practices and procedures of pay fixing in the Government.

For example, it is my understanding the agency, even though exempt from the position classification provisions of the Classification Act, will nevertheless continue to classify its jobs in a manner fully consistent with job classification under this act, so that there will be no obscurity as to occupational classification and grade level allocation as between the positions in the NASA and positions which are subject to the Classification Act.

Moreover, it is my understanding that no additional organization will be established by this agency to obtain the necessary field data on pay rates paid by non-Federal employers, but instead will be able to rely on existing data-collecting organizations.

The principle of fixing rates of pay which compare reasonably with current compensation of non-Federal employees engaged in broadly comparable work is not new. I understand the NACA currently has nearly half its employees already compensated under a prevailing rate system with which it has had many years of experience.

This experience augurs well for the successful extension of this principle to the additional categories of positions which this legislation will authorize. The Agency in all respects except pay, that is to say except for the exemption from the Classification Act and the Federal

Employees' Pay Act of 1945, will be subject to all of the civil service and personnel control laws which presently apply to the NACA.

In view of the special circumstances of this new space agency, I believe that special provisions for the establishment of pay rates such as have been proposed are warranted. With the emphasis that has been given to the principles of equal pay for equal work and other controlling principles we are confident that this pay plan can operate successfully.

This departure from the somewhat traditional rigid provisions of the Classification Act pay structure should permit the needed flexibility and responsiveness to prevailing pay practices which are thought to be so essential for the successful operation of this uniquely new program.

It has seemed to me for some time that the way in which the Government establishes the rates of pay for most of its white-collar workers is antiquated and not geared to the needs of Government personnel management as we know them today.

The efforts to meet the Government's salary needs by the establishment of rigid statutory pay scales for Classification Act and postal employees, and the difficulties that this imposes upon both the legislative and executive branches are very well known.

The pay system proposed in S. 3609 represents a different approach than heretofore made toward a relief from the difficulties and headaches connected with the present basis of setting most Government salaries by statute. Even though in itself this experiment may create new and different personnel management headaches it would seem to be a step worth taking; an experiment that should be made and, which I might add, being experimental, is quite in keeping with other objectives of this proposed legislation.

I am convinced that the authority proposed for NASA in section 6 (b) (2) of S. 3609 will provide a pilot operation in the personnel field which may help materially our efforts to develop a better way of setting salaries. I urge its adoption.

Thank you.

Senator JOHNSON. Thank you very much, Mr. Chairman. We appreciate your recommendations.

Counsel, do you have any questions?

Mr. VANCE. A few questions, Mr. Chairman.

CIVIL SERVICE NOT CONSULTED IN DRAFTING BILL

Mr. Ellsworth, was anyone in the Civil Service Commission consulted about the provisions of this bill before it was drafted?

Mr. ELLSWORTH. No. We did not have a part in the drafting of it.

NECESSITY FOR EXEMPTION

Mr. VANCE. Is it your view that there is a compelling need for the exemption provisions which are contained in section 6 (b) (2)?

Mr. ELLSWORTH. We have been given to understand that there is a compelling need due to the nature of the agency, the urgency from the standpoint of time for their work, and the necessity that they not be hampered in any way whatsoever, and we accept that as being valid.

Mr. VANCE. Could you tell us what other agencies have such an exemption as far as they are concerned?

Mr. ELLSWORTH. This is the first and only time that this type of an exemption has been made. There are many other exemptions to the Classification Act. For instance, the TVA, Tennessee Valley Authority, has a different pay and employment situation, and so has the Atomic Energy Commission, and so has the Foreign Service of the State Department, and so on.

But this is the first time, so far as I know, wherein an agency will be given authority to pay on a prevailing rate basis, meaning a rate competitive with non-Federal employment.

EFFECT OF EXEMPTION ON OTHER AGENCIES

Mr. VANCE. Do you have any views as to what the effect of such an exemptive provision might be with respect to other agencies? Might it not have a disruptive effect?

Mr. ELLSWORTH. That is a possibility I think we will have to reckon with. It is a fact, however, that the exceptions heretofore made, and I think there are nearly 40 of them, don't seem to have had any material effect on other agencies at the time they were made.

Then there is the second answer to that question, and that is that this Agency, relatively speaking, will be quite small and probably will not enter into competition with other Government agencies for personnel. The competition, I believe, will be with non-Federal employment.

Mr. VANCE. Mr. Chairman, if the pay scale is substantially higher in the Space Agency, let us say insofar as scientists are concerned, it would seem entirely possible that a scientist would prefer to work for the Space Agency rather than for another agency where his pay scale was much lower.

Mr. ELLSWORTH. Actually, Mr. Vance, I think that he probably would rather work for the Space Agency anyway because it is going to be and is already a very dramatic and—I heard someone use the word today—exotic Agency.

Yes, it would make some difference. There is no question but what there would be a desire on the part of the employee to work for the new Agency. As a matter of fact, I think that is probably what was in mind in drafting the bill this way, that they want the choice of the very best of all scientists and technical people that they can get.

Mr. VANCE. Now, Mr. Chairman, do you support the provisions of section 6 (b) (2)?

Mr. ELLSWORTH. Yes, I do, Mr. Vance, and for the reasons given in my statement which to us are very cogent and very worthwhile reasons.

We in the Civil Service Commission—and I am sure the personnel people of many of the agencies, and I am sure the congressional committees would agree—feel that the present method of setting or arriving at pay schedules for the Government workers in the classified service is not adapted to a government which employs more than 2 million people. I mean it is a cumbersome and inflexible way of doing something.

We are seeing it even as of today when for 2 years pay adjustments for postal workers and the classified service have been before Congress

and those bills are still not settled. The debate on them has consumed many, many days and hours and committee work has consumed a lot of time.

It is my feeling, that this proposal represents a sort of a pilot plant operation. It can't do any harm. It isn't big enough to unbalance the personnel situation in the Government in any way. But we can learn a lot about personnel management on this basis by observing the functioning of this Agency under these conditions. Frankly we approached our approval of this section on that basis. We think it is a good experiment and one that is worth making, and the reasons for not doing it are not very powerful.

Mr. VANCE. Thank you, Mr. Chairman. I have no further questions.

QUESTION OF SETTING MAXIMUM SALARIES

Senator JOHNSON. I want to ask this question, Mr. Chairman. In your opinion would it be more desirable for Congress rather than the Civil Service Commission to establish maximum levels of compensation beyond the Classification Act for this personnel?

Mr. ELLSWORTH. I am not sure that I understand the question, Mr. Chairman. Our ceiling in the Classification Act is $16,000 for grade 18. We have to do with the setting of grades below that, but that is the extent of our authority regarding compensation.

Senator JOHNSON. Do you think it is all right for you to fix a limit and this bill to provide none?

Mr. ELLSWORTH. Well, if I understand your question properly, with reference to the pay proposal in this bill, in this section, there isn't any restriction given to us, to the Civil Service Commission. In fact, the bill doesn't appear to have any particular limitation.

Senator JOHNSON. You think there should be?

Mr. ELLSWORTH. That is a question Congress will have to answer itself. It is a policy question. It has crossed my mind that—this is highly imaginary on my part, I am sure—but it has crossed my mind that there might be some person in the world that our Government considered very vital to this program and in order to employ that person, it might be necessary to pay a very large amount of money. If that kind of a situation existed, I assume that a limitation would not be proper but that it should be possible to pay the necessary salary. Whether that ever could happen I don't know. But that would be rationalization for that idea.

Senator JOHNSON. Counsel?

QUESTION OF ESTABLISHMENT OF SALARIES BY EXECUTIVE INSTEAD OF CONGRESS

Mr. SIEGEL. Mr. Chairman, the purpose of this question is to determine whether, as a policy matter, the Civil Service Commission should be given the power normally exercised by Congress to establish a salary scale for a specific agency or group of employees.

Mr. ELLSWORTH. Oh, with reference to section 6, the Civil Service Commission would not have the authority to establish the rates. The rates would be established by the Agency.

Mr. SIEGEL. The bill provides, "under regulations prescribed by the President" and I assume the Civil Service Commission would exercise that function for the President.

Mr. ELLSWORTH. If the Civil Service is given that function by the President, we will operate accordingly under it. The bill doesn't say that the President would assign those functions to the Commission. I would assume that they would be assigned to the Commission, however.

Mr. SIEGEL. Would there be any harm, in your judgment, in having the Commission prepare studies and its new schedule of salaries for these exempted personnel, and then transmit such recommendations to the Congress for final approval at that time, before the actual salaries went into effect?

Mr. ELLSWORTH. Well, that is an interesting idea.

Mr. SIEGEL. Would you consider that and submit your recommendation to the committee on the possibility of an amendment in this provision?

Mr. ELLSWORTH. I will be glad to do that. I would like to ask that we do this: That our staff people confer with you so that we have a meeting of minds as to what it is you want, what you have in mind, and then we will be glad to do what we can to prepare the language.

Senator JOHNSON. All right, Mr. Chairman. That will be done, and we will have our counsel confer with your staff people and we will see if we can work out some amendment along that line.

Mr. ELLSWORTH. We would be glad to cooperate in any way we can on that.

(The material requested of Mr. Ellsworth is as follows:)

UNITED STATES CIVIL SERVICE COMMISSION,
Washington, D. C., May 16, 1958.

Mr. GERALD W. SIEGEL,
Counsel, Special Committee on Space and Astronautics,
United States Senate, Washington, D. C.

DEAR MR. SIEGEL: In response to Chairman Johnson's request at the hearings of May 13, 1958, on S. 3609, I am submitting in the absence of Chairman Ellsworth draft language to amend section 6 (b) (2) of the bill and drafts of additional sections which I believe are necessary to provide the method you suggest of establishing pay schedules for NASA.

The drafting was done rather hastily and without much opportunity for perfecting the language; we hope, however, that it meets all of the issues.

It occurs to me that the bill as presently drawn, or as it might be amended under the attached drafts, needs a provision which would protect the existing salaries of present NACA personnel, who are transferred to the new Agency, until such time as new pay schedules are in effect. It would also seem necessary to provide some means for determining pay of other employees who will be appointed to NASA in the interim period between the effective date of the act and the time any new pay plan becomes effective.

If we can be of further assistance in this matter, please let me know.

Sincerely yours,

WARREN B. IRONS,
Executive Director.

SUGGESTED AMENDMENT TO SECTION 6 (b) (2)

(2) (A) subject to the civil service laws to select, appoint, and employ such officers and employees as may be necessary to carry out the provisions of this Act; (B) to classify the positions thereof under the policies, procedures, and standards of the Classification Act of 1949, as amended; and (C) without regard to sections 603 and 604 of Title VI of such Act, to fix and adjust the compensation of such officers and employees in accordance with basic pay plans recommended by the Civil Service Commission and approved by Congress as provided in sections— and — of this Act;

SEC. —. (a) The Civil Service Commission shall conduct, or cause to be conducted, on a periodic or continuing basis, such surveys, investigations, and studies as are necessary for the Commission to determine and recommend a basic-pay

plan and revisions thereof for the positions to which section 6 (b) (2) of this Act applies.

(b) Such basic-pay plan shall include—

(1) One or more schedules of rates of basic pay for each grade of the Classification Act of 1949, as amended, which rates are consistent with the public interest, are reasonably comparable with prevailing rates paid by non-Federal employers for broadly comparable work, and have such application, geographically, as prescribed in the plan; and

(2) Such rules or regulations as the Commission may prescribe for the installation, administration, or revision of the basic-pay plan.

(c) Basic-pay plans and revisions thereof, prepared by the Commission, shall be submitted to the President and upon his findings that such basic-pay plans, or revisions thereof, are necessary to accomplish the provisions of this section he shall transmit such basic-pay plans, or revisions (bearing an identifying number), and his findings, together with cost estimates, to the Congress. The delivery to both Houses shall be on the same day and shall be made to each House while it is in session.

(d) The basic-pay plan shall take effect as of the first day following the expiration of the first period of sixty calendar days, of continuous session of the Congress, following the date on which such basic-pay plan is transmitted to it; but only if, between the date of transmittal and the expiration of such sixty-day period there has not been passed by either of the two Houses a resolution stating in substance that that House does not favor such schedule or schedules.

(e) For the purposes of subsection (d)—

(1) continuity of session shall be considered as broken only by an adjournment of the Congress sine die; but

(2) in the computation of the sixty-day period there shall be excluded the days on which either House is not in session because of an adjournment of more than three days to a date certain.

(f) Any provision of the plan may, under provisions contained in the plan, be made operative at a time later than the date on which the plan shall otherwise take effect .

SEC. —. (a) The provisions of this section are enacted by the Congress—

(1) as an exercise of the rulemaking power of the Senate and the House of Representatives, respectively, and as such they shall be considered as part of the rules of each House, respectively, and such rules shall supersede other rules only to the extent that they are inconsistent therewith; and

(2) with full recognition of the constitutional right of either House to change such rules (so far as relating to the procedure in such House) at any time, in the same manner and to the same extent as in the case of any other rule of such House.

(b) As used in this section, the term "resolution" means only a resolution of either of the two Houses of Congress which states in substance that the resolving House does not favor the proposal submitted by the President as provided in section — of this Act for the establishment, revision, adjustment, or modification of the basic-pay plan for the Agency.

(c) A resolution shall be referred to the Committee on Post Office and Civil Service of the Senate or the Committee on Post Office and Civil Service of the House of Representatives, as the case may be.

(d) (1) If the committee to which has been referred a resolution has not reported it before the expiration of ten calendar days after its introduction, it shall then (but not before) be in order to move either to discharge the committee from further consideration of such resolution, or to discharge the committee from further consideration of any other resolution which has been referred to the committee.

(2) Such motion may be made only by a person favoring the resolution, shall be highly privileged (except that it may not be made after the committee has reported a resolution), and debate thereon shall be limited to not to exceed one hour, to be equally divided between those favoring and those opposing the resolution. No amendment to such motion shall be in order, and it shall not be in order to move to reconsider the vote by which such motion is agreed to or disagreed to.

(3) If the motion to discharge is agreed to or disagreed to, such motion may not be renewed, nor may another motion to discharge the committee be made with respect to any other resolution.

(e) (1) When the committee has reported, or has been discharged from further consideration of, a resolution, it shall at any time thereafter be in order (even though a previous motion to the same effect has been disagreed to) to move to

proceed to the consideration of such resolution. Such motion shall be highly privileged and shall not be debatable. No amendment to such motion shall be in order and it shall not be in order to move to reconsider the vote by which such motion is agreed to or disagreed to.

(2) Debate on the resolution shall be limited to not to exceed four hours, which shall be equally divided between those favoring and those opposing the resolution. A motion further to limit debate shall not be debatable. No amendment to, or motion to recommit, the resolution shall be in order, and it shall not be in order to move to reconsider the vote by which the resolution is agreed to or disagreed to.

(f) (1) All motions to postpone, made with respect to the discharge from committee, or the consideration of, a resolution, and all motions to proceed to the consideration of other business, shall be decided without debate.

(2) All appeals from the decisions of the Chairman relating to the application of the rules of the Senate or the House of Representatives, as the case may be, to the procedure relating to a resolution shall be decided without debate.

Senator JOHNSON. Thank you very much. We are glad to have seen you again. You are excused. The committee will take a recess until 10 o'clock tomorrow morning when we will have the legal adviser of the Department of State, Mr. Loftus Becker.

(Whereupon, at 4:20 p. m., the hearing was recessed, to reconvene at 10 a. m., Wednesday, May 14, 1958.)

NATIONAL AERONAUTICS AND SPACE ACT OF 1958

WEDNESDAY, MAY 14, 1958

UNITED STATES SENATE,
SPECIAL COMMITTEE ON SPACE AND ASTRONAUTICS,
Washington, D. C.

The special committee reconvened, pursuant to recess, at 10:05 a. m., in the Caucus Room, Senate Office Building, Senator Lyndon B. Johnson (chairman) presiding.

Present: Senators Johnson and Green.

Also present: Cyrus Vance, consulting counsel; Eilene Galloway, special consultant; Dr. Glen P. Wilson, technical coordinator; Gerald W. Siegel, Stuart French, and Solis Horwitz, professional staff members.

Senator JOHNSON. The committee will come to order.

Our first witness this morning is Mr. Loftus E. Becker, the legal adviser to the Department of State.

Mr. Becker, it has been obvious from the very beginning that the whole problem of outer space focuses attention on questions of international importance. For this reason, we are very anxious to have the State Department's attitude toward this bill.

I am asking unanimous consent to place in the record a copy of your biography and background. You may proceed thereafter as you please.

(The biography referred to is as follows:)

BIOGRAPHY OF LOFTUS BECKER, THE LEGAL ADVISER, DEPARTMENT OF STATE

Mr. Becker was born in Buffalo, N. Y., on April 29, 1911. Mr. Becker graduated from Harvard College in 1932, attended the University of Vienna for 1 year, and graduated from the Harvard Law School in 1936.

He began the practice of law in Honolulu in 1936. In 1938, Mr. Becker returned to New York, where he has practiced since that time with the firm of Cahill, Gordon, Reindel & Ohl, save for three periods of Government service. The first was in the Army from 1942 through 1945; the second was with the Central Intelligence Agency from spring 1951 to mid-1953, where he served as Deputy for Intelligence in 1952 and 1953. He has served as the Legal Adviser of the Department of State since 1957.

STATEMENT OF LOFTUS E. BECKER, THE LEGAL ADVISER, DEPARTMENT OF STATE

Mr. BECKER. Thank you, Mr. Chairman. I would like to express on behalf of the Department and myself appreciation for the opportunity to appear before you. The Department of State has a deep and abiding interest in the problems of outer space. What the United States Government should do with respect to this entirely new field of activity—with its as yet unexplored potentialities—poses highly

important questions of national policy and of defense policy. It also inevitably poses highly important questions of foreign policy.

In my testimony today I propose, after referring very briefly to certain basic principles, to discuss four major aspects of the problem of outer space. These are as follows:

1. The problem of insuring that outer space is used for peaceful purposes only;
2. Possible international cooperation in outer space;
3. International law affecting outer space; and
4. The pending bill.

BASIC PRINCIPLES

The basic pattern of our existing foreign policy with respect to space is no different from that which we have with respect to international relations here on the earth. In conformity with our undertakings under article I of the United Nations Charter, it is our purpose to insure that—in space as on the earth—international peace and security are maintained and that international disputes or situations which might lead to a breach of the peace are adjusted or settled in conformity with the principles of justice and international law.

We are in favor of international cooperation in solving international problems. At the same time, we are dedicated to the maintenance of the legitimate national interests of the United States and we hold firm to our inherent right of individual and collective self-defense against armed attack, which is fully recognized under article 51 of the United Nations Charter.

I believe that my testimony today will demonstrate that the Department's policy with respect to outer space is wholly consistent with the basic principles I have just described.

THE PROBLEM OF ENSURING THAT OUTER SPACE IS USED FOR PEACEFUL PURPOSES ONLY

The most immediate problem in the field of space foreign policy is how to ensure that outer space is used for peaceful purposes only.

As your chairman put it in his opening statement before this committee:

> The challenge of the atomic age, at the beginning, was to harness a vast destructive power to prevent its use in war.
>
> The challenge of the space age, at the beginning now, is to open a new frontier to permit its use for peace.

You are doubtless well aware that the United States Government has already taken an initiative in this field. The United States recognized the importance of determining now what steps can be taken to assure that missiles and other outer-space vehicles, already in the development stage, will be utilized solely for peaceful purposes.

This recognition stemmed from the fact that today these military space instruments are in the early stages of development.

With the passage of time and their continuous growth and refinement, the problem of effective international control becomes more difficult. This point is best illustrated by a similar historical problem. In 1946, international control of the military use of nuclear energy could have been attained with relative ease. Today, as we well know, control of the atom has become a much more vastly complicated and difficult task.

Fully cognizant of this lesson of history, the United States proposed to the United Nations on January 14, 1957, that—

> the first step toward the objective of assuring that future developments in outer space would be devoted exclusively to peaceful and scientific purposes would be to bring the testing of such objects under international inspection and participation.

This was the first recognition by any nation of the immediate need to deal with this compelling problem.

Since that time we have repeatedly stressed the need—and our willingness—to reach agreement in this vital area. During the 1957 United Nations Disarmament Subcommittee meetings in London, in concert with our allies, we formally proposed beginning measures to control for peaceful purposes, the sending of objects through outer space. This proposal reflected our earlier expressions of concern over the dangers of surprise attack and the outbreak of accidental war. It represents an extension upward of our aerial and ground inspection proposals. This proposal was designed to allay these same dangers which are inherent in the continued growth and proliferation of missile-delivery systems.

Again, in January of this year, President Eisenhower in a letter to former Premier Bulganin, expressed our concern and our desire to reach agreement on this matter. I should like to quote from that letter, which reads in part:

> I propose that we agree that outer space should be used only for peaceful purposes. We face a decisive moment in history in relation to this matter. Both the Soviet Union and the United States are now using outer space for the testing of missiles designed for military purposes. The time to stop is now.
>
> I recall to you that a decade ago, when the United States had a monopoly of atomic capabilities and of atomic experience, we offered to renounce the making of atomic weapons and to make the use of atomic energy an international asset for peaceful purposes only. If only that offer had been accepted by the Soviet Union, there would not now be the danger from nuclear weapons which you describe.
>
> The nations of the world face today another choice perhaps even more momentous than that of 1948. That relates to the use of outer space. Let us, this time, and in time, make the right choice, the peaceful choice.

Today, we have pending before the Disarmament Commission of the United Nations, a proposal set forth at London in August 1957. It stands as 1 of 5 basic principles overwhelmingly endorsed by the United Nations as the basis for continued disarmament negotiations. This proposal calls for nations to cooperate in the establishment of a technical committee to study the design of an inspection system which would effectively cover the field of ballistic missiles and other outer space objects to assure their development for exclusively scientific and peaceful purposes. Moreover, we have offered to join immediately in such a study, on a multilateral basis, without awaiting the conclusion of negotiations on other substantive proposals.

The Department of State believes that this proposal represents a significant first step toward preventing the use of outer space for military purposes. We intend to continue to emphasize the need to turn this proposal into constructive action.

POSSIBLE INTERNATIONAL COOPERATION IN OUTER SPACE

I turn now to our second major area of interest, namely, the challenging opportunities for international cooperation in outer space

study and exploration. As you have heard from previous witnesess, this new venture into our universe opens a vast area for programs of scientific study and exploration.

At this time I have in mind certain projects from which every nation in the world can benefit: Radio-relay satellites which will provide for near-perfect worldwide radio; TV and radio-telephone service; weather-charting satellites which will afford early warning against natural catastrophe; aids to navigation which will enable aircraft and ships to chart their way over the surface of the earth with great accuracy and speed; construction of space platforms as takeoff points for further outer-space exploration; and manned moon rocket flights to the moon and other planets. These are but a few of the many valuable programs we can anticipate.

These programs can have far-reaching international implications. Without proper international coordination and cooperation, such activities could lead to involved international problems and could project narrow rivalries into this new field.

Here, however, as with the military implications, one significant fact is readily apparent. The national programs of the two nations now having the technological capability to carry out outer space exploration are still in their early development stage. This limitation will not long exist. Thus, early action is essential if we are to thwart narrow national objectives.

There are, moreover, certain technological relationships between areas of potential international cooperation and the military programs which involve outer space. A most obvious illustration of this is the close relationship between the missile-propulsion systems and the means of putting scientific satellites into orbits. Yet it makes clear that an international program of scientific study and exploration is related to efforts to assure the use of outer space for peaceful purposes. There are many other highly technical considerations of this order involved here. Such considerations at the present time are under very active study within the government.

The Department of State feels, however, that there are possible arrangements for international cooperation in the peaceful scientific and technological areas of outer space activity. These arrangements could be pursued independently of control arrangements over military uses of outer space. Such cooperation would avoid conflicts of exclusively national programs. It would allow for necessary coordination of activities, thus assuring the most productive efforts. It would facilitate progress through a combination of efforts which would greatly accelerate scientific discoveries. It would provide a means by which many nations would participate in this new venture. It would insure that the scientific study of outer space is carried on in the classic tradition of scientific openness. Finally, such cooperation would set the pattern for further space activities, thus assuring the world of a logical and peaceful progression into the reaches of outer space.

To foster and guide the cooperative efforts that are possible, we believe it to be axiomatic that some appropriate international machinery should be created. Its principal responsibility would be to promote and to coordinate efforts in the field of outer space. Its functions might include, among other things, the establishment of certain international space regulations; the collection and exchange of information; and appropriate planning and coordinating of outer

space research and exploration. To undertake these functions properly, the agency might well be established under the auspices of the United Nations, but, in any event, should have a suitable and necessary relationship with the United Nations and with other international organizations such as the World Meteorological Organization. In this respect, a precedent has already been set. I refer specifically to the International Atomic Energy Agency. As you are aware, this Agency has the task of both promoting international exchange and scientific cooperation, as well as assuring that nuclear materials in its possession are used exclusively for peaceful purposes. There is no reason to believe that a space organization formulated along similar lines could not be just as effective—or more effective, since we have this IAEA experience from which to draw.

At this time, we in the State Department envisage no obstacles—political or technical—which would preclude the establishment of such an international system of cooperation and coordination.

We, in fact, believe that only through the creation of such an international organization will the interests of science and humanity be amply protected and assured.

I should add that international space cooperation is already imbued with some encouraging possibilities of collective action. In March of this year, the Soviet Union placed on the provisional agenda of the 13th General Assembly an item calling for, among other things:

> the establishment of a United Nations agency for international cooperation in the study of cosmic space.

This could mean that the first imperative step has been taken—recognition of the need for international cooperation in this field.

If this is so—it allows for an initial atmosphere of hope. Yet, even here, there remain initial problems.

This proposal I have just quoted is tied to a broad international agreement which includes, among other things, a provision for the elimination of foreign military bases. That is an old Soviet proposal and one we are not prepared to accept.

Further, we see no link between international space cooperation and elimination of foreign bases.

Thus it is clear that a number of other steps must be taken before we can gain the staggering opportunities and benefits which await a peaceful, international venture into this new world.

We have yet to reach a practical agreement which offers assurance that space shall be devoted to peaceful purposes and that there shall be international cooperation in exploring its infinite bounds.

Until a satisfactory agreement has been reached, we in the State Department shall maintain and preserve every national right of the United States in the atmosphere and in space.

INTERNATIONAL LAW AFFECTING OUTER SPACE

Now I turn to a few principles of international law which affect outer space.

The first is article 51 of the United Nations Charter.

I refer to this because I have read a number of articles in which it is stated that the only international agreement relating to space or to the atmosphere is the Chicago Convention of 1944, relating to

civil aviation matters. I have seen it asserted that there is no international law with respect to space outside the atmosphere.

I regard such statements as incorrect because of the specific provisions of article 51 of the United Nations Charter to which I have previously referred.

Under that provision, each of the members of the United Nations reserved its "inherent right" of individual or collective self-defense against armed attack.

Now the origin of an armed attack against the United States, or the particular point in space through which it would have to pass in order to reach the United States or one of its collective security partners, is completely immaterial.

The United States is prepared at all times to react to protect itself against an armed attack, whether that attack originates in outer space or passes through outer space in order to reach the United States.

The point I would like to emphasize is that if and when the United States takes such action, it will be exercising a right which it has under international law, because that law in the last analysis is what nations will agree to. And the inherent right of individual and collective self-defense has been recognized as a fundamental principle of international law in the United Nations Charter.

Turning now to the International Geophysical Year, I believe that there is another misconception with respect to the rights of the United States in this sphere that I should like to correct.

I have several times seen it stated that we do not have any right to protest or take any action with respect to satellites, because of the events relating to the International Geophysical Year.

Now, the facts are these:

The arrangements with respect to the International Geophysical Year were not made on an intergovernmental basis. They were arrangements made between scientific bodies in a private capacity.

It is true that certain governments, including the Soviet Union and the United States, announced in advance that during the International Geophysical Year they intended to place objects in orbit around the earth. And it was also stated in connection with these announcements that the purpose of these satellites would be for scientific investigation. No nation protested these announcements.

It follows, therefore, that the only conclusion that can be reached with respect to the arrangements regarding the International Geophysical Year is that there is an implied agreement that for the period of the International Geophysical Year, it is permissible to put into orbit satellites designed for scientific purposes. Once the year is over, rights in this field will have to be determined by whatever agreement may be reached with respect to such objects.

Is there any agreed upper limit of sovereignty?

That is the next question of international law—particularly the position of the United States regarding its sovereignty upward.

There are those who have argued that the sovereignty of the United States ends with the outer limits of the atmosphere, and that space outside the atmosphere is either free to all or should possibly be conceded to be within the sovereignty of one or another international organization.

I have also seen it suggested that it should be likened to the high seas, free to all.

The United States Government has not recognized any top or upper limit to its sovereignty. This position has been taken entirely apart and aside from article 51 of the United Nations Charter and any limitations that may be inherent in that, such as "armed attack."

It is true that in such international agreements as the Chicago Convention of 1944, which relates to civil aviation, the parties thereto recognize that each of them "has complete and exclusive sovereignty of the airspace above its territory."

But it is important to note that there is nowhere in the Chicago Convention of 1944 or other international agreements comparable thereto any definition of what is meant by the term "airspace."

I do not wish to take here, nor has the State Department ever officially taken, a definitive position as to how this term "airspace" should be defined.

I think it important to note, however, that one of the suggestions that has been made in this regard is that the airspace should be defined to include that portion of space above the earth in which there is any atmosphere.

I am informed that, astronomically, the earth's atmosphere extends 10,000 miles above its surface.

It follows that it would be perfectly rational for us to maintain that under the Chicago Convention the sovereignty of the United States extends 10,000 miles from the surface of the earth, an area which would comprehend the area in which all of the satellites up to this point have entered.

At any rate that type of definition would afford us enough elbow room for discussion.

Furthermore, although the United States in its domestic law, as well as in agreements such as the Chicago Convention, has plainly asserted its complete and exclusive sovereignty over the airspace above its territory, at no time have we conceded that we have no rights in the higher regions of space.

One rationale for this position which seems to me self-evident was that the United States had no need to define its position with respect to what rights, if any, it might possess outside the earth's atmosphere until such time as mankind had demonstrated a capability of existing outside the atmosphere.

Even after such a capability is demonstrated, there will be no imperative requirement in international law that the United States make any claims of sovereignty in order to protect its rights.

A very apt analogy is afforded by the Antarctic.

There, for many, many years, the United States has been engaged in activities which under established principles of international law, without any question whatsoever, created rights upon which the United States would be justified in asserting territorial claims. I mean by that, claims to sovereignty over one or more areas of the Antarctic.

Notwithstanding this fact, the United States has not asserted any claim of sovereignty over any portion of Antarctica, although the United States has, at the same time, made it perfectly plain that it did not recognize any such claims made by other states.

Nonetheless, the United States has been consistent in asserting that under international law and practice, its activities in the Antarctic Continent have entitled it to rights in that area which it has at all times expressly reserved.

It is the position of the United States Government, and one well founded in international law, that the fact that the United States has not based a claim of sovereignty over one or more areas of Antarctica, upon the basis of the activities it has engaged in there, in no way derogates from the rights that were established by its activities.

So, too, in outer space, the United States has already engaged in activities which, it could be asserted, have given to it certain rights as distinguished from those states who have not engaged in such activities. Up to this time, the United States has made no claims of sovereignty based upon such activities.

As in the situation with respect to Antarctica, this should not be interpreted as any concession of any kind whatsoever on the part of the United States that its activities have not given it certain rights in space which, in turn, could be relied upon as the basis of a claim of sovereignty.

Should space law be codified at this time?

I would like now to turn to the question of whether or not the law of space should be codified at this time.

As you know, the development or the tendency of development of the common law, as it is applied in the United Kingdom and the United States and a number of other countries, has been on a case-to-case basis.

Speaking very generally, it has been felt that the soundest way to progress in the extremely complex field of the law is by means of specific decisions on specific questions presented by specific fact situations.

Even in those states which applied the principles of the civil law, it is recognized that a body of law can only be created upon a broader body of ascertained fact.

Moreover, there are very great risks in attempting to transmute a body of law based upon one determined set of facts into a body of law with respect to which the basic facts have not yet been determined.

Accordingly, we are inclined to view with great reserve any such suggestions as that the principles of the law of space should be codified now or that the principles of the law of the sea should be applied in space, until we ascertain many more facts with respect to conditions in space.

Basically, it is the position of our Government that the law of space should be based upon the facts of space, and that there is very much more that we have to learn about the conditions existing in space before we shall be in a position to say what shall be the legal principles applicable thereto.

THE SPACE AGENCY BILL

In my testimony, I have attempted to demonstrate to you that the Department of State has a great interest in the subject of space and, particularly, its relationship to problems of foreign policy, foreign relations, and international law in this new field.

It is the expectation of the Department that its studies and activities with respect to space would continue as before, following the establishment of the space agency provided for in the administration's bill.

The difference would be that we would have a central point within the Government to which we could turn for enlightenment on non-

military research and developments in space and with whom we could cooperate in the development and implementation of meaningful plans for international cooperation in the peaceful exploitation of space for the benefit of all mankind.

We believe that this was contemplated by the bill, as introduced, since it would be inferred that international cooperation would be effectuated through the normal channel therefor; namely, the Department of State.

We understand that it has been proposed that the bill be amended to include as one of the activities that the proposed agency may engage upon a program of international cooperation.

It is our understanding that the specific language proposed reads, as follows:

> The agency may under foreign policy guidance by the Department of State engage in a program of international cooperation in work done pursuant to this Act and in the peaceful application of the results thereof, pursuant to agreements negotiated by the Department of State, or approved by that Department.

We also understand that this proposed amendment has the approval of the administration.

I should like to state that it is entirely satisfactory to the Department of State. I believe that what I have already said will have indicated that this Department is fully in accord with a program of international cooperation in the field of space, so long as that can be accomplished with due regard for the common defense and security of the United States.

CONCLUSION

Mr. Chairman, in commenting upon a space proposal made by the President in a letter to former Chairman Bulganin, you stated:

> I agree with the President that outer space must be dedicated to the advancement rather than to the destruction of mankind. It is the obligation of responsible leadership to proceed to specific proposals that will convert a noble goal into a noble reality.

We in the Department of State fully concur with your statement. We regard the opening of the space age as a time of great opportunity for mankind. We shall make every effort to insure that the keynote of space internationally is peace and cooperation, rather than strife. We hope that other nations will join us in that high effort.

EXECUTIVE AGREEMENTS DIRECTED BY PRESIDENT

Senator JOHNSON. Thank you very much, Mr. Becker. I think that you have made a very fine statement. I have a few questions.

In view of the concern expressed yesterday by Senator Bricker that the proposed language which you have just read in connection with the next to the last page of your statement, would conflict with the constitutional provision allowing only the President to make executive agreements, I wonder how you would feel about accepting a modification which would read, "Under the direction of the President"?

Mr. BECKER. That would be perfectly satisfactory, Mr. Chairman. We always operate, as you know under the direction of the President.

Senator JOHNSON. Would you give me a memorandum on that suggestion, together with the Department's recommendation?

Mr. BECKER. I will, sir.

(The recommendation referred to appears at the end of the testimony)

PROPOSALS BEFORE THE UNITED NATIONS

Senator JOHNSON. Now let's turn to page 10 of your statement. There you say:

> In March of this year, the Soviet Union placed on the provisional agenda of the 13th General Assembly an item calling for, among other things, "the establishment of a United Nations agency for international cooperation in the study of cosmic space."

In view of statements made in the Congress and the President's letter to Bulganin and the rather rapid developments in this field, doesn't our cheek kind of blush with shame when we realize we didn't make some proposal of that nature ourselves; that we have to react to the Russians, instead of taking the initiative and making affirmative proposals ourselves?

Mr. BECKER. Mr. Chairman, I would like to answer that question this way. As I have noted in my statement, we had already some time before made a proposal that we get together with the Russians and anybody interested in the subject.

Senator JOHNSON. I have noticed when somebody suggests that something be done, the classic, stock, regular, day-to-day answer of the State Department is, "We did that some time ago." Then they pull out a mimeographed statement that shows that a day ago or a month ago or a year ago or a decade ago they made a statement that somehow remotely resembles the proposal.

But to get back to my original question, in view of the rather rapid developments in this field, don't you think it would have been advisable and in our national interest if we could have made an affirmative, positive proposal to the United Nations prior to the Russian suggestion of March of this year?

Mr. BECKER. Well, Mr.——

Senator JOHNSON. I understood the Secretary to say that the President was giving consideration to it. I know early in January, before the President's letter to Bulganin, suggestions were made to that effect. I know when he sent the letter to Bulganin it indicated concentrated thinking in that field.

Now what did we do during January and February and March to put forward a positive, affirmative proposal that would arrest the attention of the peaceful people of the world?

Mr. BECKER. Mr. Chairman, I think it is a very serious issue that you have raised, and I would like to comment on it.

As I have said, I think the record is clear that we had a considerable time before proposed that outer space be devoted to peaceful purposes.

Senator JOHNSON. You are speaking now of your August 1957 proposal?

Mr. BECKER. It was in 1957. It was continued by the President, and the Secretary made a similar proposal. We have made it continuously; since—I believe it was January in either 1956 or 1957—it was first made by Ambassador Lodge in the United Nations.

Now it was our hope that people would come and talk with us about that proposal. One of the first things——

Senator JOHNSON. About the proposal, now, that you made in August 1957?

Mr. BECKER. We made it earlier than that, Mr. Chairman.

Senator JOHNSON. You don't make any reference to it in your statement. You say August in this statement. Let's tie down the date and see what proposal you are talking about.

Mr. BECKER. All right, sir, I have it here.

Senator JOHNSON. If you have difficulty locating it, just put the date in the record.

Mr. BECKER. I'll put the date in the record.

(The date referred to appears at the end of the testimony)

Senator JOHNSON. It was reaffirmed August 1957?

Mr. BECKER. It was.

Senator JOHNSON. What have you done to follow up and expand it since then?

Mr. BECKER. We have devoted a considerable amount of study to the problem of cooperation in outer space, as the Secretary had indicated. It had been discussed at the highest levels in the Government. You can approach this problem either of two ways. One of the ways is that in which, apparently, the U. S. S. R. approached it for a long time, and that is with an effort to get a propaganda advantage. Because, you will recall that their proposal with respect to cooperation in outer space was coupled with what we regard as a wholly unacceptable linkage. That is to say, you give up all your bases overseas. It was our hope that they would sit down with us and talk, and it was our feeling that if we sat down and began to talk with some sincerity, there was more chance of working something out than merely issuing propaganda statements.

Senator JOHNSON. That is good. So we have studied and hoped from August until now.

Mr. BECKER. Well, I believe that my statement will indicate that we do not look unfavorably upon cooperation in the outer space field, and that we have already said that the really unacceptable portion of the Russian position is the linkage with the elimination of our bases overseas.

Senator JOHNSON. I want to know what we have done besides study and hope. I want the record to show if we have done anything to follow up on what you describe as a policy of this Government that was initiated in January of 1957 and I guess reiterated in August of 1957. What have we done to follow up and expand that proposal to the peoples of the world?

Mr. BECKER. Well, it was directed at the peoples of the world who, up to now, have not indicated any willingness to discuss the point.

Senator JOHNSON. Have we extended an offer or proposal such as the March 1958 Soviet proposal for international exploration of outer space?

Mr. BECKER. That proposal stands in the record, as I have previously stated. The portion of the proposal we are not willing to discuss is to link those two questions. If they insist there will be a linkage of the elimination of United States bases overseas with any cooperation in outer space, we are not prepared to discuss on that basis.

Senator JOHNSON. Aren't there some steps that the Department is prepared to take or to suggest that we should take now? And shouldn't we explore these possibilities fully?

Mr. BECKER. We are indeed exploring them, Mr. Chairman.

Senator JOHNSON. Don't you think that some progress is better than a stalemate?

Mr. BECKER. I think progress is better than a stalemate, but I am not certain we can make any progress unless other people are willing to discuss with us.

Senator JOHNSON. I quite agree with you. Now what are we doing to follow up and to make an affirmative proposal through the United Nations that we explore outer space together?

Mr. BECKER. Well, you have undoubtedly seen the material that has been published with respect to a possible summit meeting.

Senator JOHNSON. Oh, yes.

Mr. BECKER. And all the way through, discussion with respect to outer space has continued to be one of the points that we have advanced.

Senator JOHNSON. I didn't realize, though, that we had regarded that possible summit meeting with a great deal of approval. I wonder if we need to wait on a summit meeting to take any steps in this field.

Mr. BECKER. Mr. Chairman, I know of no way that you can make people sit down and talk with you unless they are willing to do so.

Senator JOHNSON. Do you know of anybody lately even suggesting that we sit down and talk to them in this field? Has Ambassador Lodge made any statement since the first of the year in the United Nations? Has any public statement been made other than the Secretary's statement at the Press Club that he has given consideration to the proposal?

Mr. BECKER. Well, according to my best recollection, these statements have been made.

Senator JOHNSON. Would you insert them in the record at this point—any proposals and statements—to assure the committee that we are active and aggressive and alert and on top of this thing?

Mr. BECKER. I shall.

(The material referred to appears at the end of the testimony).

CONSULTATION AND PREPARATION OF THE BILL

Senator JOHNSON. I gather that the Department fully approves of the suggested wording, which you just read, regarding the international cooperation amendment to the act.

Mr. BECKER. We do, yes, Mr. Chairman.

Senator JOHNSON. Were you consulted in the original drafting of the bill?

Mr. BECKER. In the normal course, we received a copy of the bill from the Bureau of the Budget asking our views on it.

Senator JOHNSON. Before it came to Congress?

Mr. BECKER. I believe it came to us on the 27th of April. I would like permission to correct that if it is an erroneous recollection, but I believe it was the 27th of April.

(The corrected date appears at the end of the testimony).

Senator JOHNSON. It came to Congress in the early part of April, didn't it

Mr. BECKER. I believe it did, yes.

Senator JOHNSON. April 2.

Mr. BECKER. The first I heard of it coming into the Department was on the 27th of April. I'm not aware that the Department was consulted in the actual drafting of the bill.

Senator JOHNSON. So apparently the Department received a copy of the bill 3 weeks after it had been sent to the Congress.

Mr. BECKER. If my recollection is correct.

Senator JOHNSON. That may account for the failure to include in the original draft the amendment relating to international cooperation.

Mr. BECKER. Mr. Chairmen, let me attempt to correct myself on that. Did it come out as a congressional print very soon after it went to Congress? If that is the case, of course, we would routinely receive a copy of the bill. I was referring to the time when our comments on the bill were requested, so that it is entirely possible that we received, or almost certain, that we received a copy of the bill, but that was the time when our comments were requested by the Budget Bureau.

Senator JOHNSON. The bill was introduced in the Senate on April 14.

Mr. BECKER. Yes, I would assume that we would have a copy of the bill as soon as it was introduced, but I was saying the time when our comments were requested, and I was not aware that we were consulted in connection with the drafting of the bill.

Senator JOHNSON. Don't you think it would have been better if you had had a chance to review it and make your suggestions before the bill came down and was introduced?

Mr. BECKER. It is always better if you have more time to comment or suggest.

Senator JOHNSON. Have you any other suggestions to make concerning improvements that should be made in the bill?

Mr. BECKER. No, I have not, Mr. Chairman, nor does the Department.

MAKING INTERNATIONAL AGREEMENTS

Senator JOHNSON. Do you think the use of the word "agreements" in the suggested section plus the fact that they would have to be approved by the Department of State in any way encroaches upon the power of the President to negotiate agreements?

Mr. BECKER. No, Mr. Chairman, because I think actually—I don't think the proposed language is necessary, because it is well recognized that the Secretary of State and the Department of State act only at the direction of the President.

ROLE OF STATE DEPARTMENT IN THE IGY

Senator JOHNSON. What role has the Department of State played in the International Geophysical Year?

Mr. BECKER. I checked into that question, Mr. Chairman. We have now close liaison with the various agencies that are engaged in the International Geophysical Year, and Dr. Brode, our science adviser, is informed as to what happens. It is my understanding, however, that the Department did not, as such, participate in the arrangements leading to the International Geophysical Year.

Senator JOHNSON. Has the Department taken any part in any arrangements to extend the IGY or any part of it?

Mr. BECKER. Not to my knowledge, Mr. Chairman.

LIAISON WITH NEW AGENCY

Senator JOHNSON. Do you think that the new section that we have discussed adding to the bill implies a well-established liaison between the new agency and the State Department?

Mr. BECKER. Yes, Mr. Chairman.

VANGUARD AND FOREIGN POLICY

Senator JOHNSON. Would you not agree that failure to relate the Vanguard project to our national security problem created problems for the Department of State in the conduct of our foreign policy?

Mr. BECKER. I'm not aware of any difficulty in our foreign policy that has been created by the Vanguard project, as a project.

SATELLITE PASSAGE AND SOVEREIGNTY

Senator JOHNSON. Is it likely that either the United States or the Soviet Union will ever declare that the passage of a satellite over its territory will constitute an infringement of sovereignty?

Mr. BECKER. I didn't quite get that question. Would you repeat it, please?

Senator JOHNSON. Is it very likely that either the Soviet Union or the United States will declare that the passage of a satellite over its territory will constitute an infringement of soverignty?

Mr. BECKER. Mr. Chairman, I wouldn't like to answer that question hypothetically. You would have to ask it in the context of the specific fact situation existing at the time. I would point out that there are a number of factors you would have to consider in that relation, because one is the question of what is your reaction to their doing something, and the other is the question of whether you, yourself, want to do it. You would have to very carefully balance that in order to determine the position you would take. I would much prefer not to answer it hypothetically.

Senator JOHNSON. Do you think the answer to the question might be different if it developed that a satellite could be mistaken for an ICBM?

Mr. BECKER. I think that you have put your finger, Mr. Chairman, on a very difficult point, because ultimately, a decision might have to be made as to whether the passage of a particular object, for example, constituted such a threat to your security that you regarded youself as entitled to react against it.

Now, that is a determination that would be shared, certainly by both Defense and State. It would be a very serious determination.

NEGOTIATIONS ON OUTER SPACE

Senator JOHNSON. Are you going to furnish for the record a complete account of the negotiations by the United States Government on outer space—both within and outside the United States? Will you furnish that information to the committee so that we may be aware of what steps we have taken?

Mr. BECKER. Well, Mr. Chairman, I'll have to refer that back to the Department on that particular point, because diplomatic negotiations are usually regarded as privileged.

Senator JOHNSON. Do you mean we may have had some negotiations or made some proposals that the Department wouldn't want the committee to know about?

Mr. BECKER. That we would not want to be made public; yes, sir, Mr. Chairman.

Senator JOHNSON. Could you so indicate, if that is the fact?

Mr. BECKER. As I say, I shall refer that to the Department.

Senator JOHNSON. And give us some reply and the reasons for it.

Mr. BECKER. Surely.

(The material referred to appears at the end of the testimony).

Senator JOHNSON. Senator Green?

NATIONAL SPACE POLICY AND DEFENSE SPACE POLICY

Senator GREEN. In the first place, let me congratulate you on the very interesting and illuminating paper which you have submitted.

Mr. BECKER. Thank you, sir.

Senator GREEN. I would like to ask you a few questions, largely only to make clearer the contents.

You speak at the very beginning, the first paragraph about the posing of highly important questions of national policy and of defense policy. Where do you draw the line between the two?

Mr. BECKER. The line I meant to draw, Senator Green, was between civilian and military activities in outer space. I was thinking of national policy as being the civilian aspect of it that would not necessarily be included in the defense policy. I think you could define national policy to include defense policy.

Senator GREEN. I don't know whether you are using policy in the defense field and the national field in different senses when you apply it to outer space and when you apply it to the earth.

Mr. Becker. No; I did not intend to do that.

Senator GREEN. You are using it in the same sense?

Mr. BECKER. Using it in the same sense.

Senator GREEN. That there shall be a national policy and a defense policy.

Mr. BECKER. Yes, sir.

Senator GREEN. Throughout?

(Mr. Becker nods.)

Senator GREEN. Thank you.

DISCUSSION OF SPACE "OBJECTS"

Now, you are saying:

> In concert with our allies, we formally proposed beginning measures to control for peaceful purposes the sending of objects through outer space.

What do you mean by objects?

Mr. BECKER. That word was used to be as all-inclusive as we could make it. It would include, to take the things that are most commonly thought of now, either a missile or a satellite.

Senator GREEN. Yes; but those are illustrations of objects. I don't know that they are all-inclusive.

Would you call a sound wave an object?

Mr. BECKER. No; I would not call a sound wave an object.

Senator GREEN. Would you call a light ray an object?

Mr. BECKER. No; I would not.

Senator GREEN. Where do you limit objects? How do you define it?

Mr. BECKER. I would say something having mass in the generally colloquially accepted sense.

Senator GREEN. What is the generally accepted sense, in your words?

Mr. BECKER. Something tangible, something that you can feel.

Senator GREEN. Is it generally in all languages? What would be the Russian for "objects?"

Mr. BECKER. I don't know that.

Senator GREEN. In your proposals to Russia, have you used the word "objects?"

Mr. BECKER. Would you repeat your question, Senator Green?

Senator GREEN. In discussions of this subject with Russia, have you used the word "objects" as having a specific meaning?

Mr. BECKER. No; I think we have used—this is a proposal that was brought out in the United Nations. I am not aware that we have had any other than letters or discussions of the subject in published letters, any discussions on this point, any definition of this particular term.

Senator GREEN. Do you think that the United States and the Russians use it as having the same meaning?

Mr. BECKER. I don't even know what the Russian term is.

Senator GREEN. Your answer is, you don't know?

Mr. BECKER. Pardon?

Senator GREEN. Your answer is that you don't know?

Mr. BECKER. I don't know.

I may say I am not aware that the Russians have used the term.

Senator GREEN. Well, has the idea been discussed between you?

Mr. BECKER. Not as I am aware of.

Senator GREEN. The idea of objects?

Mr. BECKER. No; it has not.

INTERNATIONAL COOPERATION AND ELIMINATION OF FOREIGN BASES

Senator GREEN. Let me see, I have just jotted down questions as you read your paper.

On page 11, you say:

> Further, we see no link between international space cooperation and elimination of foreign bases.

What do you mean by that? What had you in mind?

Mr. BECKER. We believe that cooperation in outer space can be discussed separately and apart from the elimination of foreign bases of the United States.

Senator GREEN. But they cannot be discussed together; is that what you mean?

Mr. BECKER. We are not prepared to discuss the elimination of our foreign bases in that context. We have overall disarmament proposals.

Senator GREEN. That is what you have done. Aren't you capable of discussing them both together?

Mr. BECKER. My answer to that, Senator Green, would be that we reject the inference that in order to discuss cooperation in outer

space, we should be prepared to concede that that may be a quid pro quo for the elimination of our foreign bases.

Senator GREEN. Yes; but you see—you say you see no link. That means there is no link yet agreed on, but doesn't mean that there could be no link?

Mr. BECKER. Everything is possible, but we are not prepared to admit that link.

Senator GREEN. You are not prepared to concede it?

Mr. BECKER. That is correct.

Senator GREEN. Are you prepared to claim it?

Mr. BECKER. We are not prepared to claim it, because we reject it.

Senator GREEN. You object to it?

Mr. BECKER. Yes, sir.

Senator GREEN. You want to keep them entirely distinct?

Mr. BECKER. That is correct, Senator Green.

Senator GREEN. You are worried that with the discussion linked with foreign bases, elimination of foreign bases might result from agreement on international space cooperation. Is that right?

Mr. BECKER. Not in our view, Senator Green.

Senator GREEN. It couldn't follow?

Mr. BECKER. We think before we eliminate our foreign bases, we are going to have to have a basis of constructive progress in disarmament as a whole.

Senator GREEN. That is just what I asked you, and I thought you answered it the opposite way.

If there is established a link between international space cooperation and foreign bases, in other words that was agreed upon, couldn't it follow that that would result in elimination of foreign bases?

Mr. BECKER. Oh, I understand you now.

That is correct, Senator Green.

Senator GREEN. Have any proposals been made to that effect?

Mr. BECKER. The only proposal of which I am aware is this Soviet proposal.

Senator GREEN. Have you made any counterproposal?

Mr. BECKER. No; we have objected to the Soviet proposal.

Senator GREEN. Yes; but have you made any counterproposal? That is what I asked.

Mr. BECKER. No; we haven't, sir.

Senator GREEN. Why not?

Mr. BECKER. Because we felt our position was clear when we indicated that the primary objection we had was to the linkage between elimination of bases and cooperation in space.

It is the purport of my testimony today, I believe, that we are willing to discuss cooperation in space exploration independently of the elimination of the foreign bases.

Senator GREEN. Well, have you made such a proposal?

Mr. BECKER. We have not made such a proposal.

I think you could use, as a basis for discussion, the Russian proposal.

Senator GREEN. You have made no other proposal. You haven't made any proposals to Russia; have you?

Mr. BECKER. We have, as I have indicated.

We have asked them to sit down on what we regard as an even more important question: the guaranty that space will be devoted to peaceful purposes only.

That is the proposal we have affirmatively made.

Senator GREEN. Have you made any other affirmative proposals?

Mr. BECKER. Well, we have included in the items that were suggested for a possible summit conference discussion of that general question, too.

Senator GREEN. Now, have they acted on both of those proposals?

Mr. BECKER. Their position up to this point—as I understand it—is—and this is according to the most recent word we have had on the question—is that any discussion of joint exploration of space will be linked with the elimination of United States military bases abroad.

Senator GREEN. What is your reply to that?

Mr. BECKER. We reject the linkage.

Senator GREEN. Then, have they made any other proposals besides that common proposal?

Mr. BECKER. No; I do not believe they have.

Senator GREEN. You have reached a deadlock, then, on the question of whether that should be included or not, and, otherwise, no proposals have been made on either side, as I understand it.

Is that right?

Mr. BECKER. That is correct.

DEFINITION OF "OUTER SPACE" AND "AIRSPACE"

Senator GREEN. How do you define outer space, which you have used in various places?

Mr. BECKER. I am not prepared to define outer space exactly at this time.

There are a number of definitions that could be suggested.

One is that it is the area outside the atmosphere. There is no generally agreed definition of the atmosphere or the airspace.

As I indicated in my testimony, it might be said to extend as high as 10,000 miles.

Other proposals have been made that it should be thought to be that area above the earth's surface where there is some aerodynamic lift. That would be, of course, a much more limited definition.

Insofar as the proposals are concerned, we would intend to discuss all types of what are now known as space missiles or orbiting objects.

Senator GREEN. Well, in what sense do you use it in this statement, this written statement you have submitted?

Mr. BECKER. We use it in the sense to include discussion of what are now missiles or satellites, to include discussion of what shall be done with respect to those objects.

We haven't made any final definition of the specific area, and would like to discuss the pacification of the objects, because it may take us some time to reach a generally agreed-upon definition of outer space, as distinguished from airspace.

To some extent, there are facts lacking in order to make a final determination on that point.

Senator GREEN. Well, on page 12, for instance, to use an illustration—you were using it as fairly definite. You say:

whether that attack originates in outer space or passes through outer space in order to reach the United States.

So you make a definite distinction between the two, whether it originates in outer space or passes through outer space. Then you give a very vague statement that it is incapable of definition.

Mr. BECKER. With regard to that statement, it doesn't make any difference how far out outer space it, because the right to protect yourself against an attack would extend out as far as an attack could originate.

Senator GREEN. No; but it implies delineation of some—you speak of "originates in outer space" or "passes through outer space."

You must have some more or less definite idea as to what you are talking about.

Mr. BECKER. Senator Green, I think you are reaching for preciseness in an area where, today, because of lack of adequate facts, we cannot be precise.

I think that we are using these terms in a rather colloquial sense, as I have said, to include the area where your satellites and your space vehicles penetrate. We cannot be a great deal more exact at this time, but I think people generally understand what we have in mind.

Senator GREEN. Well, it is so difficult for them to understand it, if you don't yourself.

On page 15, you say that you have never taken a definite position as to this term "airspace."

Mr. BECKER. That is correct.

Senator GREEN. That is a different word from "outer space"?

Mr. BECKER. Yes.

Senator GREEN. What is your distinction between the two?

Mr. BECKER. "Airspace" is a term that is used both in the Paris Convention of 1919, which relates to civil avaition—that particular convention was never ratified by the United States—and, also, in the Chicago Convention of 1944, relating to civil aviation, which was ratified by the United States.

The International Civil Air Organization was set up under the Chicago Convention of 1944. There is not contained in that convention any definition of "airspace," so that there isn't any generally agreed definition.

Some of the difficulty I am having is that even the scientists don't agree as to how "airspace" should be defined. That is certainly joined in by the lawyers who try to interpret these conventions, because there just is not agreement as yet on that point.

Senator GREEN. So when you use it, you use it without definition and it is a vague term.

Mr. BECKER. It is indeed.

Senator GREEN. And it is a case of any atmosphere or no atmosphere?

Mr. BECKER. Well, one possible definition is as far as the atmosphere extends. I may say that aside from this rather extreme 10,000 miles, there was an article the other day indicating that some responsible scientist said that there were indications of atmosphere up to 40,000 or even 200,000 miles from the surface of the earth.

Senator GREEN. And you might use it—the term might be used having that meaning

Mr. BECKER. I think the latter is a little too extreme, Senator Green, to be in context.

Senator GREEN. Then that would be the outside limit.

Mr. BECKER. I would say 10,000 miles could well be taken as an outside limit, although we have never taken any exact position on the point.

Senator GREEN. A good point is if you do reach an agreement with the Soviet Government whether or not you can use any of these terms, the difference between the Russian and the English language as well as the difference in ideas have to be agreed upon; have they not?

Mr. BECKER. Well, Senator Green, I think in all fairness that the discussions between the Soviet Union and ourselves, if they once begin, can avoid some of these problems of definition of things like outer space or airspace because you might take another approach. You might, for example, concentrate on the type of objects that you have in mind and say that this general class of objects will be devoted to peaceful purposes and you may well accomplish your objective there without defining these other terms. That is not, may I say, unusual in our own law. As you undoubtedly well know, you sometimes make rules depending on the characteristics of the activities you engage in.

For example, you have one rule relating to the extraction of petroleum, another rule relating to mining, and another rule relating to subsurface waters. They are all activities underneath the earth.

So, too, you might say that an orbiting object has characteristics that are very definitely different regardless of whether it is in the airspace or the outer space.

Senator GREEN. There are so many new discoveries and inventions that it is very hard to plan for the future with a vocabulary appropriate for it. That is one of the things.

Mr. BECKER. That is one of my difficulties.

Senator GREEN. You speak, in another place, about the atmosphere—rights outside the earth's atmosphere. It is very difficult to define by reason of definition; isn't it?

Mr. BECKER. In parts, yes.

Senator GREEN. And you speak about until such time as mankind has demonstrated the capability of existing outside of atmosphere. Well, now, in addition to the experiments—at least the Soviets are experimenting. They have sent up a dog and I think a man.

Now I read in the paper the other day about men going to higher heights than they have ever reached before. We have got to change our terminology continuously as they proceed to advance. I can imagine easily an invention of some sort or another, a machine, in which a man might go beyond this 10,000 miles, might he not?

Mr. BECKER. He might indeed, sir.

Senator GREEN. And we will have to take that into consideration in this agreement if we ever expect to reach any.

Mr. BECKER. We would have to take that into consideration, and one of our difficulties here is lack of factual knowledge as to what the conditions are when you get out that far or how men react when they get out that far. That is why to some extent we have been inclined to say if you can only agree that you will act peacefully when you get out there, if and when you do, you have made a great step forward.

EFFORTS TOWARD PROPOSALS

Senator GREEN. Well, is any effort being made now to reach such an agreement?

Mr. BECKER. Well, Senator Green, we have indicated that we are prepared to discuss the question and we would do our best to do so. We have not been able to obtain the agreement with the other side that they want to sit down and discuss with us.

Senator GREEN. But have you made any new proposal or do you expect to make any new proposal?

Mr. BECKER. I daresay that there are always different proposals under various stages of preparation in the Department. I am not prepared to say exactly what we may do in a particular context.

Senator GREEN. Are you now planning such a proposal?

Mr. BECKER. We always have under consideration such proposals.

Senator GREEN. Then your answer is "Yes."

Mr. BECKER. Yes.

Senator GREEN. You are planning such a proposal.

Mr. BECKER. I won't say we are planning a definite proposal to be put out on a certain day. We have the subject under constant study as to what proposal we could make.

Senator GREEN. You hope to make a proposal as a result of all this study, I suppose. Is that right?

Mr. BECKER. Well, I would say, "Yes, we hope to."

Senator GREEN. Thank you.

SOVEREIGNTY CLAIMS IN THE ANTARCTIC

Now on page 7 you talk about Antarctica. We have never made any claim anywhere there; have we?

Mr. BECKER. No, we have not, Senator.

Senator GREEN. While other nations have made them and maintained them, have they not——

Mr. BECKER. That is correct, Senator.

Senator GREEN. And is it planned to make any?

Mr. BECKER. The other day—it was about a week or so ago—the United States made a definite proposal with respect to the Antarctic. We addressed a note to 11 nations having a direct interest, or claims of sovereignty, there. In that note we pointed out that, although some nations had made such claims, we had not, and we proposed—we expressly reserved our rights, because we do have rights in Antarctica because of our activities, and in that note we proposed that the nations agree upon an international administration for the Antarctic, and as a part of that agreement. They would all agree that the position with respect to sovereignty would become, you might say, frozen for the duration of the agreement, so that any activities engaged in during the period of the agreement would not be relied upon later as a basis for claiming sovereignty. Therefore, here was a situation where we felt that we could forget for the moment about claims of sovereignty, each of us reserving our rights, we not recognizing any claims heretofore made, they not recognizing any rights we may have, although we reserved all our rights, but we could get on with the administration of the Antarctic and continue the scientific cooperation that had existed previously with respect to the International Geo-

physical Year and also agree that that area would be devoted to peaceful purposes.

Senator GREEN. How many nations have claimed soverign rights there?

Mr. BECKER. I would have to get that figure. I think it is about 5 or 6, Senator Green.

Senator GREEN. Have those 5 or 6 all agreed in refusing to recognize this proposition of the United States that they give up some of the rights of their claim in favor of us who have made no claim to rights there? Is that right?

Mr. BECKER. We are not asking them to give up rights. We are asking them to put their rights, you might say their claims, in escrow.

Senator GREEN. Give up their sovereign rights?

Mr. BECKER. No. We are not asking them to give up their sovereign rights. We have never recognized sovereign rights. They have made a claim of sovereignty.

Senator GREEN. They don't care if you do or not, do they? They have got them.

Mr. BECKER. A claim of sovereignty makes no difference. You have rights, and a claim of sovereignty does not increase your rights.

Senator GREEN. How early did the first nation claim rights there, sovereign rights?

Mr. BECKER. I don't know that offhand, but it was a number of years ago.

Senator JOHNSON. Senator Green, could I make a brief statement? I am going to have to leave for the floor and ask you to conclude the hearing, and when you conclude your questions, counsel may have some questions he may want to ask.

I should like to announce that because of the illness of one of the witnesses scheduled this morning and a conflict of engagements on the part of another, the committee will resume its hearing in this room tomorrow morning at 10 a. m. The first witness will be Dr. Detlev Bronk, Chairman of the National Academy of Sciences.

Thank you, Senator Green. You may proceed with your examina- and, if you will, please preside.

Senator GREEN. Thank you.

I think it would be helpful if you give us a little summary of the history of the Antarctic and the claims of sovereignty.

Mr. BECKER. I will be very glad to do so, Senator Green.

Senator GREEN. Can you do so now from memory?

Mr. BECKER. No. I can't do it from memory at this moment.

Senator GREEN. Well, a number of nations—we don't know exactly how many—have made claims and maintained them for a good many years now. What proportion of the area have they claimed?

Mr. BECKER. A very large proportion. I think it is a relatively small porportion that hasn't been covered by one claim or another.

Senator GREEN. So if we put in a claim consistent with theirs, it would be a very small area, would it not?

Mr. BECKER. Not at all, Senator Green. We have engaged in activities within the areas that have been claimed by a number of other nations, and we would always have the right to claim sovereignty depending on the activities upon which we had engaged.

Senator GREEN. Well, has that sovereignty ever been challenged by anyone, even ourselves?

Mr. BECKER. We have never recognized it. We have always reserved our rights, so to that extent we have challenged them.

Senator GREEN. They don't recognize our rights?

Mr. BECKER. Oh, yes, indeed, Senator Green.

Senator GREEN. Formally?

Mr. BECKER. Formally.

Senator GREEN. All of them?

Mr. BECKER. I am pretty certain all of them. I would have to check the record on that. We have made it perfectly plain that we recognize no claims of sovereignty in the Antarctic.

Senator GREEN. You made that statement, yes, but have they been notified that you don't recognize any claims of sovereignty?

Mr. BECKER. Yes. We have made a public announcement which is addressed to everybody.

Senator GREEN. That isn't what I asked. I asked whether you had notified them that you don't recognize their claims of sovereignty.

Mr. BECKER. I am not prepared at this moment to specify the particular notices, but I shall undertake to put that in the record.

Senator GREEN. If you will kindly look that up and put it in the record later.

Mr. BECKER. Right.

(The material referred to appears at the end of the testimony.)

NEW AGENCY AS CENTRALIZED SOURCE OF SPACE INFORMATION

Senator GREEN. On page 19 you speak of—you are comparing two different things. You say:

> The difference would be that we would have a central point within the Government to which we could turn for enlightenment on nonmilitary research and developments in space—

and so forth.

Now does it make any difference—there is a difference. What is the difference? You don't say which side is which. You are not making it clear what you had intended to say, and that is why I am asking the question.

Mr. BECKER. At the present time, as I understand, Senator Green, there is no one point within the Government to which we could turn and say, "We would like information about all civilian research activities with respect to outer space." As I understand the contemplation of this bill, after the space agency is created, we would have such a central point.

Senator GREEN. If that is what you mean, the difference between the proposed bill and the existing——

Mr. BECKER. That is correct.

Senator GREEN. Is that then there would be a central point.

Mr. BECKER. That is correct.

Senator GREEN. There is a need for a new bill.

Mr. BECKER. Right.

Senator GREEN. Thank you. I am much obliged to you for answering these questions, some of which you may think were unnecessary. I assure you it helps to elucidate to those like myself who are not as familiar with the subject as you are.

I will ask the counsel now if he has any questions to ask you.

Mr. VANCE. Mr. Chairman, I have no questions.

Senator GREEN. Then I will thank you for your appearance here today. You have heard the announcement about the next meeting of this committee, and I declare this meeting adjourned.

(Whereupon, at 11:27 a. m., the committee adjourned to reconvene at 10 a. m., Thursday, May 15, 1958.)

(The material for the record, supplied by Mr. Becker, is as follows:)

DEPARTMENT OF STATE,
Washington, D. C., May 19, 1958.

Hon. LYNDON B. JOHNSON,
Special Committee on Space and Astronautics,
United States Senate.

DEAR SENATOR JOHNSON: When I appeared before the Special Committee on Space and Astronautics on May 14, 1958, I undertook in the course of the hearings to supply several items to the committee in writing subsequently.

The chairman requested a memorandum giving the Department's views on a suggestion that language be added to the administration bill making clear that any agreements for international cooperation would be negotiated and concluded "under the direction of the President." A memorandum on this matter is attached as annex A.

At page 641 of the transcript the chairman inquired as to the date when the United States made its initial proposal on the peaceful use of outer space. That date was January 14, 1957.

Later in the hearings last Wednesday, the chairman requested a record of the proposals made and negotiations conducted by the United States concerning the use of outer space for scientific and peaceful purposes only. These matters are covered in a memorandum attached as annex B.

Finally, at the hearings Senator Green requested the submission of a statement concerning claims to sovereignty over areas in Antarctica and concerning the United States attitude toward such claims. A memorandum and accompanying map concerning this question are attached as annex C.

I hope that these materials will be helpful to the committee, and trust that you will not fail to call upon me if I could provide any assistance in the future.

Yours sincerely,

LOFTUS BECKER, *The Legal Adviser.*

ANNEX A

AGREEMENTS FOR INTERNATIONAL COOPERATION IN PEACEFUL EXPLOITATION OF SPACE

It is understood that the administration bill to create a Space Agency now contains the following language on international cooperation:

"The Agency may under foreign policy guidance by the Department of State engage in a program of international cooperation in work done pursuant to this act and in the peaceful application of the results thereof, pursuant to agreements negotiated by the Department of State, or approved by that Department."

The suggestion has been made that a phrase be added to this language to state expressly that any such agreements would be negotiated and concluded "under the direction of the President." In the view of the Department of State, affirmation of this principle is, of course, completely acceptable. All international agreements are negotiated and concluded "under the direction of the President." This would continue to be true whether or not the suggested phrase were to be included in the draft legislation. For this reason to write the phrase into the legislation would be unnecessary and superfluous.

There might be some undesirability in including the words "under the direction of the President" to the extent that doing this implies that, in the absence of such language, agreements were, or might be, negotiated and concluded otherwise than "under the direction of the President."

On balance, the Department of State believes it would be preferable to omit the suggested words. If it is felt that the point requires specific attention in connection with enactment of the proposed legislation, it might be taken care of through an appropriate statement in the committee report.

ANNEX B

I. TEXT OF UNITED STATES PROPOSALS CONCERNING THE CONTROL OF OBJECTS ENTERING OUTER SPACE

1. Proposal on outer space by Ambassador Lodge in United Nations General Assembly, January 14, 1957:

"Fourth: Scientists in many nations are now proceeding with efforts to propel objects through outer space and to travel in the distant areas beyond the earth's atmospheric envelope. The scope of these experiments is variously indicated in the terms: 'earth satellites,' 'intercontinental missiles,' 'long-range unmanned weapons', and 'space platforms'. No one can now predict with certainty what will develop from man's excursion in this new field. But it is clear that if this advance into the unknown is to be a blessing rather than a curse the efforts of all nations in this field need to be brought within the purview of a reliable armaments control system. The United States proposes that the first step toward the objective of assuring that future developments in outer space would be devoted exclusively to peaceful and scientific purposes would be to bring the testing of such objects under international inspection and participation. The United States earth satellite presently planned for the International Geophysical Year is an example of an open project devoted exclusively to scientific purposes and developed with the knowledge and approbation of the scientists of the nations represented in the International Geophysical Year. In this matter, as in other matters, we are ready to participate in fair, balanced, reliable systems of control."

2. Proposal on outer space set forth in August 29, 1957, working paper by the delegations of Canada, France, the United Kingdom, and the United States in United Nations Subcommittee on Disarmament in London:

"VI. The control of objects entering outer space: All parties to the convention agree that within 3 months after the entry into effect of the convention they will cooperate in the establishment of a technical committee to study the design of an inspection system which would make it possible to assure that the sending of objects through outer space will be exclusively for peaceful and scientific purposes."

II. SUBSEQUENT UNITED STATES NEGOTIATIONS CONCERNING THE PEACEFUL USE OF OUTER SPACE

1. Ambassador Lodge's October 10, 1957, statement on outer space:

"5. Control outer space weapons: Finally, Mr. Chairman, we seek agreement on ways to control the newest creation of science—the outer space missile. Like atomic energy, this device can serve the purpose of peace or it can be used to blow us to bits. We have only begun to learn about its possibilities, but we already know that the prospect of outer space missiles armed with nuclear warheads is too dangerous to ignore.

"Mr. Chairman, in 1946 when the United States alone had nuclear weapons, it proposed to the United Nations a plan to insure the peaceful use of the new and tremendous force of atomic energy by putting it under international control. The world knows now that a decade of anxiety and trouble could have been avoided if that plan had been accepted. We now have a similar opportunity to harness for peace man's new pioneering efforts in outer space. We must not miss this chance. We have therefore proposed that a technical committee be set up to work out an inspection system which will assure the use of outer space for exclusively peaceful and scientific purposes. If there is general agreement to proceed with this study on a multilateral basis, the United States is prepared to join in this initiative without awaiting the conclusion of negotiations on the other substantive proposals."

2. Twenty-four-power resolution adopted by the General Assembly, November 14, 1957—section on outer space:

"1. Urges that the states concerned, and particularly those which are members of the subcommittee of the Disarmament Commission, give priority to reaching a disarmament agreement which, upon its entry into force, will provide for the following:

"(*f*) The joint study of an inspection system designed to insure that the sending of objects through outer space shall be exclusively for peaceful and scientific purposes."

3. Eisenhower reply to Bulganin of January 12, 1958—sections on outer space and technical committee study:

"(*a*) I propose that we agree that outer space should be used only for peaceful purposes. We face a decisive moment in history in relation to this matter.

Both the Soviet Union and the United States are now using outer space for the testing of missiles designed for military purposes. The time to stop is now.

"I recall to you that a decade ago, when the United States had a monopoly of atomic weapons and of atomic experience, we offered to renounce the making of atomic weapons and to make the use of atomic energy an international asset for peaceful purposes only. If only that offer had been accepted by the Soviet Union, there would not now be the danger from nuclear weapons which you describe.

"The nations of the world face today another choice perhaps even more momentous than that of 1948. That relates to the use of outer space. Let us this time, and in time, make the right choice, the peaceful choice.

"There are about be perfected and produced powerful new weapons which, availing of outer space, will greatly increase the capacity of the human race to destroy itself. If indeed it be the view of the Soviet Union that we should not go on producing ever newer types of weapons, can we not stop the production of such weapons which would use or, more accurately, misuse, outer space, now for the first time opening up as a field of man's exploration? Should not outer space be dedicated to the peaceful uses of mankind and denied to the purposes of war? That is my proposal * * *

"The capacity to verify the fulfillment of commitments is of the essence in all these matters, including the reduction of conventional forces and weapons, and it would surely be useful for us to study together through technical groups what are the possibilities in this respect upon which we could build if we then decided to do so. These technical studies could, if you wish, be undertaken without commitment as to ultimate acceptance, or as to the interdependence, of the propositions involved. It is such technical studies of the possibilities of verification and supervision that The United Nations has proposed as a first step. I believe that this is a first step that would promote hope in both of our countries and in the world. Therefore I urge that this first step be undertaken."

4. Eisenhower reply to Bulganin of February 15, 1958—section pertaining to outer space:

"Another new idea was that outer space should be perpetually dedicated to peaceful purposes. You belittle this proposal as one made to gain strategic advantages for the United States. Mr. Khrushchev in his Minsk speech said, 'This means they want to prohibit that which they do not possess.'

"Since the record completely disproves that uncalled-for statement, may we now hope between us to consider and devise cooperative international procedures to give reality to the idea of use of outer space for peace only.

"When the United States alone possessed atomic weapons and the Soviet Union possessed none, the United States proposed to forego its monopoly in the interest of world peace and security. We are prepared to take the same attitude now in relation to outer space. If this peaceful purpose is not realized, and the worse than useless race of weapons goes on, the world will have only the Soviet Union to blame, just as it has only the Soviet Union to blame for the fact that atomic and nuclear power are now used increasingly for weapons purposes instead of being dedicated wholly to peaceful uses as the United States proposed a decade ago.

"The Soviet Union refused to cooperate in tackling the problem of international control of atomic energy when that problem was in its infancy. Consequently, it has now become too late to achieve totally effective control although there can be, as we propose, a controlled cessation of further weapons testing and of the manufacture of fissionable material for weapons purposes. But, as your government said on May 10, 1955, a total 'ban' on atomic and hydrogen weapons could not now be enforced because 'the possibility would be open to a potential aggressor to accumulate stocks of atomic and hydrogen weapons for a surprise atomic attack on peace-loving states.'

"A terrible new menace can be seen to be in the making. That menace is to be found in the use of outer space for war purposes. The time to deal with that menace is now. It would be tragic if the Soviet leaders were blind or indifferent toward this menace as they were apparently blind or indifferent to the atomic and nuclear menace at its inception a decade ago.

"If there is a genuine desire on the part of the Soviet leaders to do something more than merely to talk about the menace resulting from what you describe as 'the production of ever newer types of weapons,' let us actually do what even now would importantly reduce the scope of nuclear warfare, both in terms of checking the use of fissionable material for weapons purposes and in wholly eliminating the newest types of weapons which use outer space for human destruction."

5. Eisenhower reply to Premier Khrushchev of April 8, 1958—section on undertaking technical studies which would include outer space:

"The United States is also prepared, in advance of agreement upon any one or more of the outstanding "disarmament' propositions, to work with the Soviet Union, and others as appropriate, on the technical problems involved in international controls. We both recognize that international control would be necessary. Indeed, your present letter to me speaks of 'the establishment of the necessary international control for the discontinuance of tests.' "

6. Eisenhower reply to Premier Khrushchev of April 28, 1958—section on outer space and technical studies:

"The United States is determined that we will ultimately reach an agreement on disarmament. In my letter of April 8, I again proposed an internationally supervised cutoff of the use of new fissionable meterials for weapons purposes and the reduction of existing weapons stocks by transfer to peaceful purposes; an agreed limitation or suspension of testing; 'open skies,' and the international use of outer space for peaceful purposes.

"As an effective means of moving toward ultimate agreement on these matters and other disarmament matters, I proposed that we start our technical people to work immediately upon the practical problems involved. These studies were called for by the United Nations General Assembly. They would include the practical problems of supervision and control which, you and I agree, are in any event indispensable to dependable disarmament agreements.

"The solution of these practical problems will take time. I am unhappy that valuable time is now being wasted.

"You say that we must first reach a final political agreement before it is worthwhile even to initiate the technical studies. But such studies would, in fact, facilitate the reaching of the final agreement you state you desire."

Annex C

Claims in Antarctica

The following countries have asserted territorial claims in Antarctica: France, Norway, New Zealand, Chile, Argentina, Great Britain, and Australia. These claims are as follows:

1. Argentina: Between longitudes 25° W. and 74° W., and south of latitude 60° S.
2. Chile: Between longitudes 53° W. and 90° W.; northern limit unspecified.
3. United Kingdom: Between longitudes 20° W. and 50° W. and south of latitude 50° S.; and between longitudes 50° W. and 80° W. and south of latitude 58° S.
4. New Zealand: Between longitudes 160° E. and 150° W. and south of latitude 60° S.
5. Australia: Between longitudes 45° E. and 136° E. and south of latitude 60° S.; and between longitudes 142° E. and 160° E. and south of latitude 60° S.
6. France: Between longitudes 136° E. and 142 ° E. and south of latitude 60° S.
7. Norway: Between longitudes 20° W. and 45° E. Northern and southern limits of the claim are uncertain since the Norwegian proclamation refers only to the "mainland coast in the Antarctic" between the two specified east and west limits as well as "the land lying within this coast and the environing sea. * * *"

The only sector remaining unclaimed is the sector between latitude 150° W. and 90° W.

The United States has reserved its rights in Antarctica both in communications to particular countries and in general statements of United States position. The following are examples:

In a note of February 24, 1934, to the British Ambassador in Washington regarding the 1934 Byrd Expedition and alleged British sovereignty in Antarctica, the Department of State reserved all of the rights of the United States or its citizens.

On May 16, 1939, our Ambassador in Paris was instructed to transmit a note to the French Minister stating, in substance, that the United States did not recognize the French claim in Antarctica.

On January 16, 1939, the Department of State transmitted a note regarding the Norwegian claim in Antarctica to the Norwegian Embassy in Washington reserving all the rights of the United States and its citizens.

In a statement of policy made by the Department of State on November 10, 1939, in connection with the third Antarctic Expedition of Admiral Byrd, the Department reiterated its position of nonrecognition of territorial claims, quoting a note of Secretary of State Hughes to the Norwegian Minister of April 2, 1924, in

which Secretary Hughes had denied the validity of Capt. Roald Amundsen's explorations as a basis for Norwegian sovereignty in Antarctica.

In a public Statement of December 27, 1946, the Department of State again publicly reasserted its position of nonrecognition of any claims of any other countries in the Antarctic and expressly reserved all of its rights in Antarctica.

Most recently, the United States has clearly reserved all of its rights in Antarctica in the diplomatic notes, made public by the White House on May 3, 1958, addressed to countries participating in the Antarctic IGY program.

These are only a few examples of the numerous instances in which the United States, either in formal or informal communications or representations to specific countries or in general statements of policy, has reserved the rights of the United States and its citizens in Antarctica. (For detailed discussion of some of the examples listed above and for other examples see Hackworth's Digest of International Law, vol. I, pp. 449 to 465.)

It is believed that the United States has clearly and consistently asserted its position, both to particular countries and to the world at large, reserving the rights of the United States and its citizens throughout all of Antarctica.

DEPARTMENT OF STATE,
Washington, May 27, 1958.

Hon. LYNDON B. JOHNSON,
Chairman, Special Committee on Space and Astronautics,
United States Senate.

DEAR MR. CHAIRMAN: This letter is supplementary to my letter to you dated May 19, 1958, forwarding certain additional material requested by the special committee.

When I appeared before the Special Committee on Space and Astronautics on May 14, 1958, you asked whether the Department of State was consulted in the original drafting of the bill (transcript 646). In reply I stated that we received a copy of the bill from the Bureau of the Budget asking our views on the bill and according to my recollection at the time, the date of receipt by the Department was the 27th of April, although I asked permission to correct my statement if my recollection was erroneous.

Upon checking the record, I found that my recollection was erroneous and that the fact is that the views of the Department of State on the administration's space bill were requested in a letter from the Bureau of the Budget, dated March 27, 1958, which was received in the Department on March 28, 1958. In this letter from the Bureau of the Budget, this Department was requested to give its views with respect to the draft bill by March 31, 1958, and this was done. Certain changes were made in the draft as a result of the comments thus furnished by the Department of State.

Accordingly, the answer to your question is that the Department of State was consulted in the drafting of the bill before it was sent to the Congress.

Sincerely yours,

LOFTUS BECKER,
The Legal Adviser.

NATIONAL AERONAUTICS AND SPACE ACT OF 1958

THURSDAY, MAY 15, 1958

UNITED STATES SENATE,
SPECIAL COMMITTEE ON SPACE AND ASTRONAUTICS,
Washington, D. C.

The special committee reconvened, pursuant to recess, at 10:05 a. m., in the caucus room, Senate Office Building, Senator Lyndon B. Johnson (chairman) presiding.

Present: Senators Johnson (chairman), Symington, Saltonstall, Bricker, Hickenlooper, and McClellan.

Also present: Cyrus Vance, consulting counsel; Eilene Galloway, special consultant; Dr. Glen P. Wilson, technical coordinator; Gerald W. Siegel, Stuart French, and Solis Horwitz, professional staff members.

NEW SOVIET SATELLITE LAUNCHED

Senator JOHNSON. The committee will come to order.

The events this morning give a new sense of urgency to the hearings that we are holding. The Soviet Union has launched successfully a new satellite. It is heavier by 100 times than anything we have put into space. The importance of this feat cannot be underestimated. It brings mankind closer and closer to an actual escape into space. It also should bring closer to us the realization that we must organize our potentialities as rapidly as possible to play our proper role in entering the new dimension that is opening up before us.

It is a pleasure to welcome Dr. William H. Pickering, director, Jet Propulsion Laboratory, California Institute of Technology.

Dr. Pickering was born in New Zealand in 1910. He studied at the California Institute of Technology, receiving a B. S. degree in 1932, a M. S. degree in 1933, and a Ph. D. degree in physics in 1935.

Dr. Pickering, I ask unanimous consent to insert a brief biographical sketch in the record, and if you will just proceed with your statement in your own way, the committee will be pleased to hear you. We know that you have a broad background in a field directly related to space technology and we are anxious to have the benefit of your experience and your advice.

(The biography referred to is as follows:)

BIOGRAPHY OF DR. WILLIAM H. PICKERING

Dr. William H. Pickering is the director of the Jet Propulsion Laboratory at the California Institute of Technology. He was born in Wellington, New Zealand, in 1910. He studied at the California Institute of Technology, receiving a B. S. degree in 1932, an M. S. degree in 1933 and a Ph. D. degree in physics in 1936.

Dr. Pickering performed graduate and postgraduate work in cosmic ray physics at Cal Tech. He has been associated with JPL since 1944 and has been director of the laboratory since September 1954. He has been a member of the Scientific

Advisory Board of the Air Force and Chairman of the Research and Development Board Panel on guided missile test ranges and instrumentation.

He is a member of the American Institute of Electrical Engineers, a fellow of the Institute of Radio Engineers and the American Rocket Society, a member of the United States National Committee Technical Panel on the Earth Satellite Program, and chairman of its work group on tracking and computation.

STATEMENT OF W. H. PICKERING, DIRECTOR, JET PROPULSION LABORATORY, CALIFORNIA INSTITUTE OF TECHNOLOGY

Dr. PICKERING. Thank you, Mr. Chairman.

Mr. Chairman, I am honored to be invited to testify before this committee. I am sorry I do not have prepared notes, but I should like to make the following remarks.

In view of the Russian launching this morning, as you said, Mr. Chairman, there is no question but that the United States must embark on a space program. However, it seems to me that in so doing, we must realize that there is a very broad spectrum of interests in space experiments, these interests covering the scientific, the military, the commercial areas and also, of course, the area of national prestige.

When I think about a space program, I am thinking in terms of vehicles which are not used for transportation from one point on the earth's surface to another. Vehicles which are either weapons or for the carriage of goods and passengers, and vehicles such as ICBM missiles, and so forth, these I treat as a separate category. I am thinking rather of a space program in which we are in fact sending vehicles out into space beyond the earth to travel for long periods of time in the gravity-free condition.

Now, in evaluating the necessity for a space program, it seems to me that it is of some interest to consider the fact that at the present time in the IGY program, the United States is supporting a rather large effort in the Antarctic. One might ask why are we supporting this Antarctic effort, and here again we see a case where an interest which is primarily a scientific interest is accounting for an expenditure of a large amount of effort, a large amount of manpower in order to support what is fundamentally a scientific experiment. We likewise should regard the support of a space program as a national necessity in the same way that the support of an Antarctic program during this IGY period is a national necessity.

It is obviously a matter of national prestige that we should have a station at the South Pole during this IGY period.

In asking what is a reasonable program for the country to develop, again I make the analogy with the Antarctic program and say that what is needed is scientific exploration. There are specific scientific experiments which I am sure have been discussed in this committee and elsewhere at great length, and I don't want to discuss these in any detail. But I will point out that the scientific experiments are a necessary forerunner to the commercial exploitation of space or the military exploitation of space. I think that a very good example is the present cosmic ray experiment which has been performed on EXPLORERS I and III. This experiment of Dr. Van Allen's has given us some completely new information about the radiations present in outer space. The information was completely unexpected. Radiation levels, a thousand times or more greater than the cosmic

ray background, have been measured. Radiation levels in fact so high as to be potentially dangerous to space travel, to human space travel.

This is a rather dramatic example of the results of a quite simple scientific experiment which was the first step out into space. Here, after we have had a vehicle in orbit for a matter of a few weeks, we are finding startling new results.

Now, I don't mean to say that every new satellite experiment is going to have equally dramatic results, but it does mean that the scientific steps must be the first steps toward the exploitation of space.

A second thing, it seems to me, which we must remember in trying to establish a space program is the fact that we are not yet in the position of being able to, as it were, take a vehicle off the shelf and say, "Here is a truck which can carry your scientific experiments where you want them." We are still in the evolutionary stage of these large rockets, this large rocket technology, and it becomes necessary, then, to plan in great detail the specific experimental vehicle as well as the experimental program. These have to be integrated together into a system.

The result of this is that any scientific experiments, even the relatively simple scientific experiment in space, are the result of long planning on the part of the vehicle people as well as the scientists, so that a well thought out space program is one which is a continuing program, a long-term program, a program which has long lead time items and therefore it must be supported on a continuing basis so that there can be this long-term planning.

It seems to me that one other factor in connection with the immediate program is that the military interest in space at the present is rather tenuous. I say this because although it is true there are some definitive military applications which we can see now, such as the reconnaissance satellite, and so forth, it is difficult to see very much beyond this point. I am quite sure that as we explore space, as we send vehicles into space for scientific purposes, that there will be military byproducts as a result. But I do not feel that the military objectives out in space are clearly enough defined at this time to say that the military program should be the governing factor in space.

I think also one should distinguish in this example between military applications as, shall we say, weapons systems as distinct from military-supported research. For example, meteorology is a field of interest to the military. It is quite clear that satellites are going to be a very useful tool for meteorological research.

Now, does this mean that meteorological research satellites should be conducted by the military or conducted by a civilian group? In my estimation the intital meteorological research program should be laid out essentially with civilian thinking. As a byproduct of this program we could very well end up with a military satellite using the results of the meteorological research which had been carried out by a civilian agency.

It seems to me one other point in connection with the military interest in space is that at the moment the biggest contribution which the military can make to our space program is to develop the large-scale, long-range rocketry which is, after all, the basis for any space exploration, and that the military objectives at this time should be concentrated on the military weapons systems using large rockets

which are now under development. These are of primary importance to the country. There is no question whatever about that. And they must be developed as rapidly as possible.

With this as a background, the question of the space agency, then, appears to me in this light. One can first of all ask, Do we need a new space agency or can the space job be done with the existing scientific and military groups in the country? And my feeling here is that a new agency is needed because of the magnitude of this program.

The costs of this program are going to very large. There is no getting away from that; large in dollars. Looked at from the point of view of national effort, one might say perhaps a quarter of a percent of the national income might be diverted to the space programs.

With a large expenditure and with a necessity for long-term planning, it appears to me that there must be a well-integrated national program, and this means, then, that a single agency should integrate and control the program rather than to have it on a catch-as-catch-can basis as some of our research activities have been up to now, and quite rightly so, because there is much research which obviously should be supported by different agencies. But when we are talking about a project of this magnitude, then I feel a single agency, a single space agency, a civilian space agency, is required. It is necessary that this agency have the imagination and the boldness to establish a program which is ambitious but not rash. It is necessary also that this agency have the continuing funds necessary to carry out such a program.

The magnitude of the efforts becomes comparable to the AEC type effort, but I feel that this is a different sort of activity than the AEC in that rather than growing out of—rather than having a program which grows out of a military requirement, as the AEC program has grown and broadened from its initial military objectives, here we have a program which I feel should start on the other side. It has more similarity to the IGY Antarctic program where the effort is initially scientific and there may be military byproducts which will develop later on, but the organization which carries out the program, rather than being an AEC type operation with strong military overtones should start in the other direction as a scientific operation which will develop military byproducts.

The present bill which proposes a new national space agency would appear to me to meet the objectives as I see it. I do feel that there is one comment I would like to make, however, and that is the association of the National Space Agency with the National Advisory Committee for Aeronautics. I feel that the new Agency has to do a job which is quite different from the job which is now being carried out by the NACA, and in this light, then, I regard the new Agency as in fact a new Agency which incidentally absorbs the NACA rather than an agency which grows out of the NACA. I believe that the wording of the bill is such as to imply this, but I merely wanted to emphasize that from my point of view I feel that this is important, that the new Agency have the authority and have the tasks assigned to it which are in the bill and which are a different set of tasks than those assigned to the NACA.

Thank you, gentlemen.

LIAISON WITH THE MILITARY

Senator JOHNSON. Dr. Pickering, we have been pleased to have your suggestions. Have you read the bill?

Dr. PICKERING. I have read the original version of the bill. I understand there are some changes, but I have not seen the latest version.

Senator JOHNSON. Do you think the new Space Agency should have a military liaison committee between the Department of Defense similar to that between the Department and the AEC? Do you think the lines of demarcation are clearly sufficient to do the job?

Dr. PICKERING. The new Agency must obviously work very closely with the military. It must use military hardware at least in its initial steps. It must use military firing teams and probably military firing facilities, and therefore there must be close liaison with the military.

I am not, however, certain as to just in what form that should be legislated, but I am certain that it must somehow be effected.

Senator JOHNSON. Senator Hickenlooper?

Senator HICKENLOOPER. Dr. Pickering, I appreciate your answers to the questions that Senator Johnson just asked you. I am also very much interested in that phase of the matter, that is, the liaison between the military requirements that grow out of this operation and the overall space responsibility.

I point out that in the atomic energy legislation, the military liaison committee was created and given certain statutory rights protected by the right of appeal for a decision on matters which the military liaison committee might think were either good or bad for the security of the United States. Perhaps in the light of your answer to Senator Johnson you may not have formed any concrete ideas on the form of that association. I know you said that you thought it should be protected or that it should be safeguarded.

Dr. PICKERING. Yes.

Senator HICKENLOOPER. But I wonder if you have an opinion on whether or not that safeguard should be written into the law in a manner which would not necessarily let the tail wag the dog, or vice versa, but give protection in both fields.

Dr. PICKERING. Yes, sir. I do. At least I would hope that we would end up with a situation where the military could not override the civilian program. At the same time, in order to not only protect the military interests but to assure military cooperation in the program, I believe that something should be written into the program so that the military felt that their interests were in fact protected.

Now, if this says the liaison committee with the right of appeal, perhaps that is the right answer. But I am sorry I just have no feeling in detail about the legislation.

Senator HICKENLOOPER. I understand your attitude favors some device which would——

Dr. PICKERING. Which would assure cooperation.

Senator HICKENLOOPER.—which would assure that the really essential military requirements of this country were not neglected. That would be acceptable.

Dr. PICKERING. Yes. When I look at the history of the NACA and its workings with the military, I find there a history of excellent relations. I find also the military assigning problems to the NACA

which they need help on. And I would like to think that a similar type of relationship could exist in this case.

I feel there is a difference in the AEC case in that the AEC's objectives, at least its initial objectives, were to provide the hardware or assist the military in providing hardware for them. And in this case it doesn't seem to me that it is quite the same problem. Here the civilian agency in its exploration of space is going to be conducting experiments, is going to be developing vehicles which the military I believe will not pick up directly, but the military will use these as a basis for developing weapons systems of their own.

Senator HICKENLOOPER. Thank you, Dr. Pickering.

That is all I have.

Senator SYMINGTON (presiding). Senator Saltonstall?

Senator SALTONSTALL. No questions.

Senator SYMINGTON. Senator Bricker?

POSSIBLE DANGEROUS RADIATIONS

Senator BRICKER. Dr. Pickering, you mentioned a while ago this band of intense radiation at a certain distance out from earth that has been discovered by the satellites already there. Have you been able to ascertain yet the nature of that radiation, whether it is direct cosmic ray or the X-ray by the impact of the electrons on the surface of the satellite?

Dr. PICKERING. Well, sir, I think we can say that it is not the primary cosmic rays. Primary cosmic rays are of much greater energy and come down to the top of the atomosphere and, of course, even to the surface of the earth. This is a radiation which is being held perhaps a thousand miles above the earth by the action of the magnetic field of the earth, and therefore it is a radiation which is due to charged particles, probably electrons, of energies perhaps a hundred thousand volts. These electrons are, as it were, trapped by the magnetic field of the earth and are not able to come down close to the earth, but in some way circulate around the earth inside its magnetic field.

Dr. Van Allen, who I understand is to appear before this committee, is, of course, more competent to speak on this point than I am.

Senator BRICKER. Is there any possibility of shielding against such radiation?

Dr. PICKERING. Yes. The problem would be equivalent to shielding a person against X-rays of about a hundred-kilovolt energy. This would take perhaps a quarter of an inch or, say, a half inch of lead and that would provide adequate shielding.

Now, when one thinks of the difficulties of getting up a spaceship and the weights required just to keep a man up there, the prospect of adding that much lead is a little discouraging. Of course, as Dr. Van Allen will tell you, this is only the first experiment. It is clear we must do more experiments to find out more about this radiation. We just don't know yet. In fact, all we know is a lower limit to the intensity. It may be much stronger than we are now estimating, and we don't know how far out into space this radiation extends. It may be possible to pass through a band of radiation fairly quickly.

Senator BRICKER. Thank you. That is all.

MILITARY AND CIVILIAN DEVELOPMENTS

Senator SYMINGTON. Dr. Pickering, it would be very difficult, would it not, to at this time decide what was military and what was not military in the way of space investigation?

Dr. PICKERING. Well, sir, if by military you mean what is a military weapons system or something which has a direct application to the military use as an end-point use, I can see such things, for example, as a reconnaissance satellite as being something about which the military can say, "Here is something we can use to see what the other fellow has."

When I think, on the other hand, of some other satellite experiments such as the meteorological experiment, I can visualize that the problem of finding out what satellites can contribute to our knowledge of meteorology and our knowledge of long-range weather forecasting, that I would regard as a scientific effort which might end up with a military end point.

It is true that in much of the science of the country now, we find the military supporting research programs of this type which will lead potentially into military applications. And, of course, if you wanted to draw the line at anything which could possibly have a military application, then practically everything one does in space I suppose would come under that category. But it appears to me that if a space agency is to be established for this purpose, one could draw the line more on the side of the applied research or the specific developments rather than the supporting research, the underlying developments, and the net——

Senator SYMINGTON. The reason for my question is that under the premise in our Government, of civilian control, right now it would be difficult to take a list and say, "This is for the military and this is for civilian."

Dr. PICKERING. Yes.

Senator SYMINGTON. Therefore if you have the head of a civilian agency with authority reporting to the President in this field, then the question as to just how the applied research should proceed would automatically come up later in discussion with the Secretary of Defense and the President plus any other advisers like Dr. Killian or anybody else with whom the President would want to discuss it.

Would that be a fair analysis of it? What I would oppose more than anything else in this bill would be any belief that in emphasizing civilian control, you are throwing a block on the military development for security. I don't think, as I read the bill, that that is characteristic of it. How do you feel about that?

Dr. PICKERING. No. I agree. It seems to me that there is no danger that military developments will be blocked. I think myself that it is perhaps a little bit the other way, that the interest in military developments may take such a large fraction of the available funds that a scientific program will have difficulty in proceeding.

Senator SYMINGTON. Well, if you do feel the latter way, is there anything in the bill that you would change to correct that? Or do you think that will just be the way it will go?

Dr. PICKERING. I think that is a problem for the Congress in allotting funds for the space activity.

Senator SYMINGTON. And not a problem of the bill, itself.

Dr. PICKERING. Not a problem of the bill, itself.

THRUST OF NEW SOVIET SPUTNIK

Senator SYMINGTON. Inasmuch as you are, certainly, one of the foremost, if not the foremost, experts in the field of jet propulsion, what thrust do you think was used to put this latest 2,900-pound sputnik in orbit?

Dr. PICKERING. Well, sir, there has been a suggestion that the Russians have been working with quarter-of-a-million-pound thrust motors. To put this in orbit would probably require two of those or, say, half a million pounds thrust.

Senator SYMINGTON. So, you think it was a two-stage——

Dr. PICKERING. Well, I don't know whether it was 2 parallel motors or 1 half-million-pound-thrust motor or something in between. Just as an order of magnitude, though, it would be in that category. In our experience, we can say that the weight in orbit is about one one-thousandth of the weight at takeoff.

Senator SYMINGTON. What was that again?

Dr. PICKERING. The weight in orbit is about one one-thousandth of the weight at takeoff. You see, for example, the Explorer has 30 pounds in orbit for about 60,000-pound takeoff. Well, that is less than one one-thousandth. The Vanguard is closer to one one-thousandth of the weight. It is a little better than one one-thousandth, but it is somewhere in that order of magnitude, between one-hundredth and one one-thousandth of the weight at takeoff.

On this basis, if you have 3,000 pounds of instruments in orbit plus, presumably, a final-stage rocket which, perhaps, weighs 2,000 or 3,000 pounds, 6,000 pounds in orbit, you have to have more than 600,000 pounds at takeoff, which would take more than half a million pounds thrust.

So, I think half a million pounds is probably a lower limit on the thrust.

Senator SYMINGTON. Thank you, Dr. Pickering.

Senator SALTONSTALL. Mr. Chairman, might I ask one question?

Senator JOHNSON. Senator Saltonstall.

ADMINISTRATIVE STRUCTURE OF THE NEW AGENCY

Senator SALTONSTALL. Dr. Pickering,do you approve of the method of selection of the Advisory Board, and do you approve of having a single director rather than a committee or commission responsible? I assume you are familiar with the act.

Dr. PICKERING. Yes, sir. Well, sir, as far as the single Director is concerned, I do approve of this, rather than a commission. I believe that a program of this kind, which has to be very definitely oriented toward a specific experimental program, the single Director will be necessary in order to progress smoothly.

On the question of the Board and the extent of military control in the Board, I think this is related to the problem of what authority the Board is to have. As I read the bill, the Board is advisory to the Director, and, as an advisory board, it certainly should represent the military interest as well as the civilian interest. But, with the present makeup of the Board being 8 from the Government and 9 from private industry, from civilian life, it would seem to me that this is a reasonable makeup on the Board.

Senator SALTONSTALL. Well, the Government has now come forward and changed that, so it is now 9 from the Government and 8 civilian.

Dr. PICKERING. Oh, I see. Well, even so, I don't have any objection to that. I certainly think that the Government interest, the military interest, must be expressed on that Advisory Board. No question about that.

Senator SALTONSTALL. Thank you.

Senator JOHNSON. Senator Symington?

VAST WEIGHT DIFFERENCE BETWEEN SOVIET AND AMERICAN SATELLITES

Senator SYMINGTON. Dr. Pickering, I want to ask another question, in an effort to be constructive.

When the first sputniks went up, some expenditure ceilings in the military were taken off. Unfortunately, these expenditure ceilings have been reapplied. Perhaps they will be taken off again, as a result of this latest Soviet accomplishment.

Nobody knows more about jet propulsion than you do, in my opinion. I have followed your career with great interest. But shouldn't the public be informed, officially, of the difference in defense significance between orbiting a 30-pound satellite and the orbiting, say, of a 3,000-pound satellite? Why is it that there has been no emphasis on that point? Frankly, the American people feel they got their sputnik up, and we got ours up. You agree with me on that, don't you, that that is the feeling?

Dr. PICKERING. Yes, sir. I certainly do agree, and I do feel that the people have been becoming much too complacent when the score a little while ago was 3 to 2; and I couldn't agree more that we must appreciate the difference between, as you say, putting up 30 pounds and putting up 3,000 pounds.

Senator SYMINGTON. In other words, what worries me is I go back into my State and I find that people feel we are sort of on a par with the Soviets, when the facts are that what we have done to date has no military significance whatever, as far as thrust is concerned, and what they have done is conclusive proof that they have the thrust capable of launching an ICBM. Is that correct?

Dr. PICKERING. Yes, sir; very definitely, sir. This 3,000-pound satellite, of course, I regard this as a tremendously important achievement in getting that magnitude of weight up there.

Senator SYMINGTON. Well, I would like to ask this question, then, at that point. This should end forever any doubt on our part with respect to their putting up any known warhead, hydrogen or otherwise, wouldn't you say, from a thrust standpoint?

Dr. PICKERING. Yes, sir. Having the capability of putting 3,000 pounds in orbit, certainly, says they have the capability of firing ICBM's with very substantial warheads.

Senator SYMINGTON. For any distances of 5,000 miles or above?

Dr. PICKERING. Or longer; yes, sir. I would also like to comment in this connection, sir, that in looking at the photographs of Sputniks I and II, you see, we have been able to take moderately good photographs as they go by, and in making calculations from the apparent brightness of these objects, and so forth, we have come to the conclusion that the size of the rocket which was in orbit with the Sputniks

I and II was somewhat larger than the rocket which launched the Explorer. This is consistent with the weights which the Russians quoted for the instrument weights of Sputniks I and II, the instrument weights, and so if there is any question in anyone's mind as to whether or not the Russians are in fact giving us the truth on these weights, I would say as far as Sputniks I and II are concerned the answer is that we have indirect evidence which says that they are correct, that those weights are probably the correct weights. There is no——

Senator SYMINGTON. To be sure that I understand you, what you are saying is that because their second stage shows that they have a larger thrust than our first stage based on actual photographs, it is very clear that they are ahead in this missile field.

Dr. PICKERING. Yes, sir.

Senator SYMINGTON. Is that correct?

Dr. PICKERING. Yes, sir.

Senator SYMINGTON. Thank you.

Dr. PICKERING. That the rocket in orbit is comparable in size or perhaps larger than the Redstone rocket which launched the Explorer.

Senator SYMINGTON. Why do you think it is that so many people consistently try to maintain the fiction, then, that our position is equal or ahead in this field?

Dr. PICKERING. I don't know, sir.

Senator SYMINGTON. It is very difficult to understand. You are the expert in this field.

Dr. PICKERING. It would seem to me that anyone who reads the papers intelligently and sees the facts of what the Russians have done; they are not hiding this from the rest of the world. The satellite is not a matter of intelligence information or anything else. It is up there for all the world to see. At the same time we can read in our newspapers what goes on at Cape Canaveral and there it is.

PROPER MANAGEMENT OF A SPACE PROGRAM

Senator SYMINGTON. You are not only a scientist, a physicist, but you also have had management experience like Dr. Karl Compton and Dr. James Killian. Based on your present work, don't you think at this point it is very clear that we should take off all restrictions of any kind whatever in our defense developments in order to be as strong as we possibly can with these new weapons?

Dr. PICKERING. I think, sir, we certainly must put all the emphasis we can in our work in this large rocket field. At the same time, I do feel that the rate of progress in this field is not entirely a matter of funds. It is a matter of people and management. And management techniques are still evolving, as it were, in these large military systems. Likewise the problem of getting the trained scientists and engineers and using them effectively is a problem which faces us in this country.

Senator SYMINGTON. Have you any suggestions you would care to give to the committee as to what should be done along those lines?

Dr. PICKERING. Well, sir, the only comment I would make is the rather obvious one that the education of scientists and engineers in the country has got to be encouraged. This is a long-term process. It is not something you get overnight. And the other comment I

would make is that when our weapons programs are once established, we should stay with them and bring them to completion. I think we have a tendency in this country to always want to develop the very latest thing. We are always afraid that we are developing something which is obsolescent. So we are in a state of always wanting to make changes in development programs as they go along. I have seen programs in which this has definitely been a difficulty.

We should establish objectives and then have the courage to believe that these are worthwhile objectives which will not be obsolete when we have accomplished them instead of always trying to bring the system up to date as we go.

Senator SYMINGTON. Would that be your comment with respect to the management field?

Dr. PICKERING. Yes; management of weapons systems.

Senator SYMINGTON. Thank you, Mr. Chairman.

Senator JOHNSON. Senator McClellan?

Senator MCCLELLAN. No questions.

SCIENTIFIC AND TECHNOLOGICAL LEADERSHIP

Senator JOHNSON. Dr. Pickering what recommendations would you make to the committee that would increase our opportunity to achieve scientific and technological leadership among the nations of the world in this field?

Dr. PICKERING. Well, sir, I feel that this is a problem which involves the whole national effort, that there must be an appreciation in the country of the significance of scientific and technological achievements, and an appreciation of the fact also that Russian technology is obviously advancing at a much faster rate than ours, and in some areas, at least, it is ahead of us. And that given this appreciation, then an acknowledgement of the fact that this is going to require a great deal of hard work on the part of our people and our technically trained people particularly. I feel this is something which has to be appreciated throughout the country and it is not something that can be done by legislative action or committee action of any sort, but it is just a general acknowledgment of the situation which we are in as far as the populace is concerned.

In other words, I think, as Senator Symington said a moment ago, that too many people in this country were prone to say that we have 3 satellites up there and they only had 2, and had no appreciation of the underlying facts, and this I believe is true in a great many technical fields. We are too complacent still. We feel that we are the technical leaders of the world, and in fact, we are now being challenged by the Russians and we must recognize the fact that we are being challenged.

Senator JOHNSON. Well, some of us do recognize it and some of us say so, and some of us advocate more vigorous action. But we still are confronted with the situation which you have outlined. Now, where do we go from there?

Dr. PICKERING. Well, sir, I feel that perhaps this latest Russian achievement is one of the things which will wake us up again, that if the people can realize the situation, then I believe that proper support for scientific and technological endeavor will be forthcoming.

Senator JOHNSON. Do you think the support for such an endeavor is inadequate at this moment?

Dr. PICKERING. In general I do not feel that the financial support of scientific work in this country is badly inadequate. We can always use more money, obviously, but it seems to me that we have the money available but somehow we are not accomplishing as much as should be done with the funds. In other words——

Senator JOHNSON. You are saying it is not so much a state of the bank account as a state of mind?

Dr. PICKERING. It is a state of mind, I believe, more than anything else.

Senator JOHNSON. And what are your suggestions for improving the situation?

Dr. PICKERING. Well, sir, I have only this feeling, that it is a matter of the national spirit, as it were, and something which has to grow through the country, and there is nothing concrete that can be done except to keep these facts before the people.

Senator JOHNSON. Are there any other questions of Dr. Pickering?

Senator SYMINGTON. Mr. Chairman, I would like to ask one more, if I may.

Senator JOHNSON. Senator Symington.

EXPENDITURE CEILINGS HAMPER DEFENSE EFFORT

Senator SYMINGTON. Dr. Pickering, based on work that you do as head of a great jet propulsion laboratory, it is a coincidence that we have you here this morning, the same day the Russians launched the sputnik.

I placed a statement in the record only yesterday. I will ask you a question about it after I read it.

With respect to what is going on now, I said in the record yesterday:

> Expenditure ceilings were determining our defense policy.

That was before sputnik. Shortly after sputnik, or thereabouts, and I quote:

> With only minor deviations and modifications these expenditure ceilings are still hamstringing our defense activity and minimizing the constructive effect of needed defense expenditures upon the economy. These artificial controls over the use of money made available by the Congress continue to be enforced in spite of inflation, in spite of the recession, and in spite of the relative decline of our defense strength vis-a-vis the Soviet.

Now, I investigated the matter thoroughly before I made that statement and I am not asking you to comment on its accuracy, but if it is true, I would ask you, don't you think that we should stop establishing expenditure ceilings on money that has been appropriated for the purpose of improving our defenses, especially in the field of newer weapons?

Dr. PICKERING. Yes, sir. It would seem to me when the Congress has appropriated money, this is an indication of the will of the people which should be carried out then by the military; yes, sir.

Senator SYMINGTON. Thank you.

Senator JOHNSON. Senator Bricker?

COST OF THE SPACE PROGRAM

Senator BRICKER. You estimate the cost at a billion dollars.

Dr. PICKERING. Yes, sir. There have been figures which have been quoted in the order of $100 million to a billion dollars a year for a substantial space program. My feeling is it will be closer to a billion than to a hundred million.

Senator JOHNSON. Any other questions?

Thank you very much, Dr. Pickering. You are excused. You have made a valuable contribution and we appreciate the suggestions you have given us. The committee will give serious attention to your recommendations. You are excused.

Dr. PICKERING. Thank you, sir.

Senator JOHNSON. Our next witness is Dr. James Van Allen, Chairman, Rocket and Satellite Research Panel, and professor of physics, at the University of Iowa.

Dr. Van Allen, will you please come to the microphone.

Dr. Van Allen, you have been active in rocket and upper atmosphere research since 1946. You have also done considerable work in the IGY program. We welcome you and express our gratitude for your coming here to give us the benefit of your experience.

Our esteemed colleague, Senator Hickenlooper, must leave because of an engagement he has previously made, but he has talked to me about your appearance.

I ask unanimous consent that we put a biographical sketch of Dr. Van Allen in the record at this point. Senator Hickenlooper, would you care to make a statement before Dr. Van Allen proceeds with his statement?

(The biography referred to is as follows:)

BIOGRAPHY OF DR. JAMES VAN ALLEN, PHYSICIST; CHAIRMAN, IGY SUBCOMMITTEE

Dr. Van Allen was born in Mount Pleasant, Iowa, on September 7, 1914. He attended Iowa Wesleyan College receiving his bachelor of science and doctor of science in 1931. From the State University of Iowa he received a master of science in 1936 and a doctor of philosophy in 1939.

He was with the Carnegie Institution of Washington from 1939–42 and with Johns Hopkins in 1942 and again from 1946–50. He was the leader of several scientific expeditions from 1949–52. He has been a professor of physics and head of the department at the State University of Iowa since 1951. He was also a research associate at Princeton University in 1953–54.

He served as a lieutenant commander in the United States Navy from 1942–46 and also worked with the OSRD during World War II. He has been a member of a subcommittee of the NACA and has been active in rocket and upper atmosphere research since 1946 as a member and now Chairman of the Rocket and Satellite Research Panel. He also heads the Working Group on Internal Instrumentation of the IGY program.

He is a member of the American Physical Society, the American Geophysics Union, and Sigma Xi. He is author of many scientific articles on the upper atmosphere and earth satellites.

STATEMENT OF DR. JAMES VAN ALLEN, CHAIRMAN, ROCKET AND SATELLITE RESEARCH PANEL AND PROFESSOR OF PHYSICS, UNIVERSITY OF IOWA

Senator HICKENLOOPER. The only thing I can say, Mr. Chairman, is that Dr. Van Allen is a very renowned physicist and has done invaluable work, of course, on instrumentation and other necessary details of certain rocket and satellite operations.

We are very proud of his work in Iowa. He is a native-born Iowa citizen, and I join with the chairman in welcoming you here, Doctor.

Senator JOHNSON. Dr. Van Allen, do you have a prepared statement?

Dr. VAN ALLEN. Yes, sir.

Senator JOHNSON. Will you proceed in your own way.

Dr. VAN ALLEN. Yes. Mr. Chairman and members of the committee, it is a very great honor for me to have this occasion to appear this morning.

I thought I should first summarize my views in order that you may know in a general way where I stand and in order to give some background for questions.

In the first place, I do consider that a vigorous national program of outer space research is essential to our maintaining scientific and technological leadership among nations of the world.

Secondly, I heartily support the President's proposals for this purpose as embodied in the National Aeronautics and Space Act of 1958, which is now pending before the Congress and before this committee. And I specifically urge that dominant authority and responsibility for the execution of this national program be vested in a civil agency.

In the way of general background on my experience in this field, I should like to say that since 1940 I have been closely associated with military weapons development. In fact, throughout World War II and for some time after that, that was my principal professional activity, working on military weapons systems and in their operational use in the Pacific Fleet and for our ground forces in Europe.

Since 1946 I have been primarily engaged in scientific work using high altitude rockets and most recently using satellites. So I feel that I do have some impression of both sides of this question, namely, the military operational and weapons requirements and the civilian scientific and educational aspects, and some impression of what the possibilities of space developments are for the general benefit of our citizenry at large.

I list the following purposes of a national space program in what I believe to be about the right order of importance for a civilian agency.

In the first place, there is a vast amount of ignorance, just simple ignorance, about what is going on in the upper atmosphere of the earth and in the space surrounding the earth. So I feel that the first, and the most basic undertaking of the civil Agency is the investigation of the phenomena of nature on a geophysical and astrophysical scale.

Second, there has been a great deal said about the aspect of human adventure and exploration. I have no special advocacy of "the man in space" undertaking. I feel that it is something which men will wish to do and in due time will do. I think the incentives are of the same nature that Magellan must have had in starting around the world, namely, just to see what is around the world; and I do believe that, in the long term, human exploration of space will possibly be a significant field of human activity.

Thirdly, there is the application of new knowledge and techniques resulting from these investigations to the promotion of the intellectual agricultural and industrial capabilities of the Nation.

Fourth, there is the aspect of the advancement of international understanding by cooperation in undertakings which are naturally

and necessarily of worldwide scope. The International Geophysical Year is certainly the most tangible and most well known example of such an undertaking.

And finally, there is the application of all the knowledge and techniques resulting from the above investigations to the development of military weapons systems and to the more effective conduct of offensive and defensive warfare.

In order that we may have as a Nation an effective space program, there are two simple things required:

In the first place, we require enabling legislation which establishes an astronautical Agency as a major Federal activity.

In the second place, we must have adequate funding on a long-term basis for the execution of this undertaking.

Many of us have been concerned with these questions for some time; and, as you probably know, various groups of us have developed informal proposals of this nature for several years.

Most of us believe that we will require something like $500 million a year for the civil space undertaking. I think one should have such a figure in mind when he is thinking of a vigorous national program, Mr. Chairman.

Now, these are my prepared remarks, and I can speak from notes on other points I have, or I shall be glad to answer questions at this point, as you like.

Senator JOHNSON. Thank you very much, Doctor.

I must leave shortly to attend another meeting, and I want to ask some brief questions. I will ask Senator Symington to preside and conclude the questioning and hear the other witnesses.

SUGGESTED CHANGES IN THE BILL

Doctor, do you have any specific suggestions to make regarding improvements in the administration bill that has been forwarded to us?

Dr. VAN ALLEN. Yes, sir; I have several specific suggestions I would like to mention.

I think the section of the bill that—now, I have actually the House version, but I understand it is identical with the Senate version, and I feel that the section dealing with the relationships between this new Agency and the Military Establishment is very vague, and I should like to invite your attention to a bill which was submitted by Representative Coad in the House on January 14.

It was designated H. R. 9966. I feel that one statement of Mr. Coad's bill is very pertinent to this matter, and it reads as follows:

The interests of the Commission—now, he was proposing a Commission rather than a Space Agency—

> shall be paramount in the field of astronautics among all Government agencies except for such aspects of the field as are determined by the President to be of clear and immediate military importance.

This section settles—or attempts to settle—the question of dominant cognizance in these matters.

I think it is clear that there is no attempt to prevent, retard, or in any way interfere with developments which are of "clear and immediate military importance." But it undertakes to establish this agency as the dominant one among all Government agencies in the field of civil space developments.

Senator JOHNSON. Do you think that a statement of policy is to be preferred to the language in the bill which says that the Congress desires such activity should be directed by a civilian agency exercising control over aeronautical and space research except insofar as such activity may be peculiar to or primarily associated with the military weapons system, military operations, and so forth?

Dr. VAN ALLEN. Yes, sir; I do feel that the statement in the Coad bill is superior, and mainly with regard to this one section of S. 3609 which I believe is rather unclear:

> may be peculiar to or primarily associated with weapons systems or military operations, in which case the agency may act in cooperation with or on behalf of the Department of Defense.

I will admit this can be interpreted that there will be no interference. However, it seems to me it may be interpreted that the Space Agency is the primarily responsible agent and it may or may not cooperate with the Defense Department.

Senator JOHNSON. In other words, are you generally satisfied with the provisions of the Senate bill?

Dr. VAN ALLEN. Yes, sir, in broad outline.

I may say I do prefer the commission principle in an agency of this sort, rather than a single director. My reason is that I think the Atomic Energy Commission has, on the whole, worked out quite well. I think the space undertaking is an undertaking of similar diversity, and I feel that a greater breadth of competence is desirable.

I think, also, that a single directorship tends to be a lifetime job. I think in an undertaking of this sort that there should be a limited term of appointment and that there should be an assured diversity of policymaking capability which changes year by year as membership of the Commission changes.

TRANSFERS TO THE NEW AGENCY

Senator JOHNSON. Do you believe that any of the present, permanent research authority of the Department of Defense with respect to the space weapons systems should be transferred to this new Agency?

Dr. VAN ALLEN. Yes, sir; I think a good bit of it might well be and should be.

Senator JOHNSON. Which part?

Dr. VAN ALLEN. I think a good bit of what is being done within the Department of Defense in this field at the present time is on a stopgap basis and is mainly and dominantly of a civil character. But it is being done by the Department of Defense as a matter of expediency because there is no other agency in the country at the present time able to undertake it.

There is much contractual work of the Department of Defense which could be transferred bag and baggage. There are many laboratories and groups of people which would prefer to be in a civil agency and which could be transferred within a year.

Senator JOHNSON. Do you think the machinery and the mechanics for that purpose are adequate as proposed in the present bill?

Dr. VAN ALLEN. Yes, sir; although I feel that 3 years is a rather long period in this field, and I should much prefer to see the transfers made within 1 year, so that the new Agency can go ahead promptly.

PARTICIPATION IN AN INTERNATIONAL SPACE PROGRAM

Senator JOHNSON. In your opinion, is it safe at this time for our country to participate in international space programs?

Dr. VAN ALLEN. Well, sir, as you of course know, we are already doing that in the IGY.

We have a vast international network of stations, and it is an internationally cooperative undertaking at the present time. I think this can be developed and extended without hazard to the Nation. I think that international cooperation in this field will have a favorable effect on our national character and security.

Senator JOHNSON. Do you think it is not only safe to do so, but essential?

Dr. VAN ALLEN. I think it will be of very great value in easing international tensions if we can genuinely cooperate on something which is a natural field of cooperation.

Senator JOHNSON. In your opinion, are there clear limitations to such international projects, as a result of military security requirements?

Dr. VAN ALLEN. I think we must go at it gradually, and with considerable circumspection, as a start.

Senator JOHNSON. Thank you very much, Doctor.

Senator McClellan?

Senator MCCLELLAN. No questions.

Senator JOHNSON. Senator Symington?

Senator SYMINGTON. I have no questions, Mr. Chairman.

Senator JOHNSON. Thank you very much, Doctor.

Our next witness is Dr. Bronk, president of the National Academy of Sciences.

Dr. Bronk, will you please come to the microphone?

Dr. Bronk, you have held some very high scientific positions in our Government, and we are grateful to you for coming to advise and consult with us today.

As background for your testimony, I ask unanimous consent to place your biography in the record.

(The biography referred to is as follows:)

BIOGRAPHY OF DR. DETLEV W. BRONK, PRESIDENT, NATIONAL ACADEMY OF SCIENCES, PRESIDENT, ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, AND CHAIRMAN, NATIONAL SCIENCE BOARD

Dr. Bronk was born in New York City on August 13, 1897. He was educated at Swarthmore College, B. A. 1920, and the University of Michigan, M. S. 1922 and Ph. D. 1926. He has received many honorary degrees. In 1926 he joined Swarthmore as assistant professor, became full professor in 1928 and served as dean of men 1927–29. He was director of the Eldridge Reeves Johnson Foundation at the University of Pennsylvania, 1929–49; director, Institute of Neurology, 1936–40 and 1942–49; and professor at Cornell University Medical College, 1940–41. He was president of Johns Hopkins University 1948–53.

He served during World War II as Coordinator of Research for the Surgeon General of the Army Air Force, as special consultant to the Secretary of War, and as Chief of the Division of Aviation Medicine of the Committee on Medical Research of the Office of Scientific Research and Development. Following the war he received the Exceptional Service Award of the Army Air Force.

Dr. Bronk is currently serving the Government as Chairman of the National Science Board of the National Science Foundation; member of the Science Advisory Committee of the Office of Defense Mobilization; member of the statutory Visiting Committee of the National Bureau of Standards; member of the Science Advisory Board of the Air Force; Vice Chairman of the NACA; member of the

Advisory Committee on Biology and Medicine, AEC; and member of the National Commission for UNESCO.

Dr. Bronk has been president of the National Academy of Sciences since 1950, and president of the Rockefeller Institute for Medical Research since 1953.

In addition to the above affiliations, Dr. Bronk is a trustee of the Philadelphia Institute for Cancer Research, Woods Hole Oceanographic Institution, Marine Biological Laboratory, the Johns Hopkins University, Rockefeller Foundation, Population Council, Protein Foundation, and Sloan-Kettering Institution.

Senator JOHNSON. The committee is ready for you to make any statement you desire. Proceed in your own way.

Excuse me; I must leave at this point. I have asked Senator Symington to preside.

STATEMENT OF DR. DETLEV BRONK, PRESIDENT, NATIONAL ACADEMY OF SCIENCES, WASHINGTON, D. C.

Dr. BRONK. As President of the National Academy of Sciences, I welcome the opportunity to speak briefly in support of S. 3609.

In doing so, I recognize that all I can say has been said on numerous occasions. With your permission, I would prefer to speak extemporaneously and prepare any report of testimony that may be desired subsequently, in the light of questions you may wish to ask me.

I recognize that one of your important considerations has been whether or not this program should be supported and conducted by a civilian agency.

The reason why I feel that the provisions of the proposed bill are correct in this regard is because my experience as a member of the National Advisory Committee for Aeronautics for 10 years has persuaded me that an agency under civilian auspices can make its contribution to science and the Nation in cordial and effective cooperation with the military services, on the one hand, and with civilian scientists and industries, on the other.

I have been impressed during these 10 years of membership on the NACA by the devoted and cordial cooperation of all the individuals and agencies of the country which have been concerned with the development of aeronautics.

I believe, also, that the proposed bill is correct in its general structure, because it recognizes that space research calls for wise international cooperation. This is a great adventure of the human mind, and certainly no one nation should or can control all such activity. Whatever agency is established will be best fitted to do so if it is best geared to the potentialities for international cooperation.

I believe that the Agency proposed makes adequate provisions for relating military activities, on the one hand, and scientific activities carried on without any specific regard for military requirements, on the other, in a common undertaking with a common focus.

This two-way flow of activity and information is of general importance. With the development of our technological civilization and with the development of our military activities along lines of scientific and technological progress, it is increasingly important that we recognize that the totality of our national effort has a broad unity. Except for difference in ultimate objectives there is no basic difference between military science and civilian science.

With these few brief general remarks, I would enthusiastically support this bill.

Senator SYMINGTON. Senator McClellan?
Senator MCCLELLAN. No questions.

COMMENTS ON LANGUAGE IN THE BILL

Senator SYMINGTON. Dr. Bronk, is there any part of the bill that you think should be changed?

Dr. BRONK. I might have introduced certain changes in emphasis. I would have made specific reference, as the President's message did, to the desirability, of close association between this Agency and the National Science Foundation and the National Academy of Sciences, in order to assure that there would be such cooperation between the Agency and the scientists of the country.

Senator SYMINGTON. Do you see any objection to having a director reporting to the President in a normal administrative way?

Dr. BRONK. No, I do not. Having served on the NACA, as I have said, for 10 years, I was well pleased with the relationship between the Director and the Committee. On the other hand, having been a university president for 10 years, I also recognize the desirability of having a more focused responsibility.

POSSIBILITY OF LIFETIME JOB FOR DIRECTOR

Senator SYMINGTON. One previous witness mentioned the possibility of it's being a lifetime job. I think that would largely depend on the way it was handled, don't you?

Dr. BRONK. I do, sir.

Senator SYMINGTON. I have never heard anybody raise any objection to Mr. Hoover being the Director of the FBI for 34 years.

Dr. BRONK. And we all know university presidents who have served long and distinguished careers.

NECESSITY FOR EARLY ESTABLISHMENT OF NEW AGENCY

Senator SYMINGTON. Would you say this matter was of sufficient urgency that you think the Agency should be set up this year or do you think it could wait until next year?

Dr. BRONK. I think it would be well to establish it this year because we are in a state of development. There is an urgency about carrying on many of our programs. As the International Geophycial Year ends, it is essential that we do not lose the momentum which has been gained under that program. If this agency is not created, I should think that other agencies would have to be utilized and this might make it difficult in the ultimate development of the Agency proposed.

At the National Academy of Sciences we are establishing a Board on Space Research in order to carry forward the activities begun under the IGY, recognizing that it is important not to have a hiatus. We would welcome the prompt creation of the NASA.

PAY SCALES IN THE NEW AGENCY

Senator SYMINGTON. How about this part of the bill which provides authority to pay scientific personnel compensation in excess of that now permitted by Federal law?

Dr. BRONK. I think this is very important, sir, because, as we all know, many of our Government agencies have suffered gravely because they have been unable to compete with nongovernmental agencies. I am one who believes that our Government deserves no less than the best.

Senator SYMINGTON. Well, if we do that, sir, don't we make it difficult for the other agencies of Government that use scientific personnel in their programs?

Dr. BRONK. It might be a very good way of encouraging them to try for the same.

Senator SYMINGTON. I must say that is a pretty good answer.

Senator McClellan?

Senator MCCLELLAN. No.

Senator SYMINGTON. Thank you very much, Doctor.

Dr. BRONK. Thank you, sir.

Senator SYMINGTON. Our next witness is Mr. Don K. Price, Jr., dean designate of the Harvard Graduate School of Public Administration?

Mr. Price, will you come up?

Mr. Price, I understand you are the author of a publication called Government and Science. And that you have done considerable work in the field of relations between the Government and science. We are looking forward to your testimony.

I ask unanimous consent to insert in the record your biography covering your experience and qualifications.

(The biography referred to is as follows:)

BIOGRAPHY OF DON K. PRICE, JR., VICE PRESIDENT, FORD FOUNDATION, DEAN DESIGNATE, HARVARD GRADUATE SCHOOL OF PUBLIC ADMINISTRATION

Mr. Price was born in Middlesboro, Ky., on January 23, 1910. He received his bachelor of arts degree from Vanderbilt in 1931 and was a Rhodes scholar at Oxford University, receiving his bachelor of arts in 1934 and bachelor of literature in 1935.

He was a reporter and editor of the Nashville Tennessean in 1930–32. From 1935 to 1937 he was a research assistant for the HOLC. He was a staff member of the Social Science Research Council from 1937 to 1939. He was assistant and associate director of the Public Administration Clearing House from 1939 to 1953.

He served in the United States Coast Guard from 1943 to 1945. He was a staff member of the Bureau of the Budget from 1945 to 1946. From 1952 to 1953 he was Deputy Chairman of the Research and Development Board of the Department of Defense. He also lectured at the University of Chicago from 1946 to 1953. He was the associate director of the Ford Foundation from 1953 to 1954 and its vice president since 1954. Later in 1958 he will become the dean of the Harvard Graduate School of Public Administration.

He has been a member of various committees on Government organization. He is also a member of Phi Beta Kappa and the author of Government and Science published in 1954, and other publications.

Senator SYMINGTON. The committee is ready for any statement that you might wish to make.

STATEMENT OF DON K. PRICE, JR., VICE PRESIDENT, FORD FOUNDATION, AND DEAN DESIGNATE, HARVARD GRADUATE SCHOOL OF PUBLIC ADMINISTRATION

Mr. PRICE. Thank you very much, Senator. I will be glad to start, if I may, by talking briefly from notes that I have made. I was on a trip abroad when I got a letter from Senator Johnson inviting

me to appear, and I did not have time to prepare a completely written statement. But perhaps it will be more useful for me to try to answer questions.

I think the problem, that makes S. 3609 a tremendously challenging piece of legislation is that we are caught up here by 2 trends that 30 years ago or even 20 years ago would have seemed inconceivable to us.

At that time, we were getting used to the idea that technology and industrialization were causing us a lot of social problems. We weren't used to the idea that we were going to have to depend every month and every day for our security on a massive Military Establishment, a necessity which I think we all take for granted today. And, second, we weren't used to the idea that the strength of that Military Establishment was going to have to depend not on a traditional corps of professional soldiers and not on a reserve of militia, but on the state of our science and technology, which is multiplying the powers of destruction, as it has become quite commonplace to say, to such an extent that no one can quite see where this leads us in the long-range future.

Now, it seems to me that these two general ideas underlie all of the important issues that are represented in this bill. And while this bill alone, of course, won't determine the future of the world, I think the kind of moves we make on it will have some effect on the way we work out the future of our relations between civilian and military power in this Government. We all hope those relations can be along the lines that are consonant with our fundamental and traditional principles. Then, too, we must consider the equally important but newer problems of the relation between responsible political authority on the one hand, and the rapidly developing influence of science on the other; this is an equally important, and I think equally difficult, problem.

Both of these problems have a great potential impact, I think, on the future relations of private and public institutions in this country, because obviously if everything that is needed for military strength is to be drawn into the military system, even on a contractual basis, the possibility of truly independent private institutions becomes very difficult for us to maintain.

I would like to discuss three general issues in this bill, and I am very glad to be able to say that I think the bill takes a sound approach to them.

The first is the issue of the military-civilian relation. The second is the issue how an agency of this sort ought to be headed. And the third is the relation of this agency to the rest of the Government.

First, as to the military-civilian relationship, I would not like to see any step taken which would even momentarily weaken the state of our weapons development. I served for some time as Deputy Chairman of the old Research and Development Board, and that experience gave me a very lively sense of the need for the continuous advancement of military technology. It made me think, too, that it would be very easy to exaggerate the difficulties of military people in getting along with scientists. I think military administrators are generally like civilians in their attitude to scientists; if they run a big bureaucratic show, they have to run it according to the rules of the game, which are not always welcome to the independent scientist. I do not argue for a civilian agency here because I think there is any-

thing in the military mind as such that makes it unsympathetic to scientific thinking. My reason for advocating a civilian agency is quite different; it is that we face in our society today a situation in which every aspect of our business and industry and agriculture and science needs to contribute to military affairs. That makes me all the more eager, therefore, not to organize all those aspects of our society under the control of the Department of Defense and the military services.

I therefore would come out quite strongly, as this bill does, for setting up this new venture, which I am sure will go ahead with a great deal of pioneering zest in the near future, as a civilian agency. And I don't see that such civilian status will involve any necessary handicap to the future of our military preparedness.

I say that even though I don't think that it is possible to draw in advance, by statutory language or any other means, a precise dividing line, with respect to scientific subject matter or types of operation, between the concerns of the agency proposed here, and the concerns of the military services.

But, as I can remember it, I could never see such a line drawn in the field of research between the Atomic Energy Commission and the military, or between the Public Health Service and the military, or the Agriculture Department and the military. I think these things have to be worked out as a practical matter with discretion and flexibility, especially since you are working here in a field of a totally new kind, where you cannot say today what the nature of the problem is going to be 12 months from now.

I am glad to see this Agency built on the basic structure of the NACA. Immediately after the war our permanent military scientific research machinery was being built up largely on a system of contracting out as much as possible. But during that time the NACA was a constant example of the advantages, for some types of purposes, of keeping a strong operation going within Government laboratories in parallel with the operations carried on in private business.

And I think the past efficiency of the NACA and its close cooperation with the military are the best reasons for believing that similar arrangement of efficient cooperation can be maintained in the future by the new agency.

I have only one general comment to add: I think it would be worse to set up this Agency on a halfway basis than not to do it at all. If the Congress of the United States wants this Agency to be a vital and vigorous partner of the military, I think it is important to give it the ability to do the job.

Therefore I was very pleased to read the provisions of this bill that give this Agency the opportunity to employ at above the normal Government salary ceilings.

I say that because I once had a great deal of experience watching people move from important jobs in the military departments to less important jobs for military contractors at very much higher salaries. And in the long run it was the Government that paid those new salaries. Unless the Agency proposed here is able to compete for personnel on equal terms with the military contractors, we are bound to have a steady drift away from this sort of responsible civilian institution, and into an undue concentration of strength in the system which is supported entirely by military contracts.

Second, then, how should an agency of this sort be headed?

And I come out on this issue without any reservations on the side of a single executive head, as the bill provides.

It is, of course, quite normal for people with primarily scientific and academic background, accustomed to a committee style of operation in laboratories and in universities, to prefer boards and commissions for scientific purposes. But this new Agency is about to move far beyond a mere research program, and beyond even the operating magnitude of the National Advisory Committee for Aeronautics, to a size of an operating program that requires vigorous executive direction. Even within the NACA, I think the success of that operation has come about in a very large part because the Board has been wise enough to delegate authority, to a very great extent, to a very able executive director.

I must say, if this Agency were starting from scratch, I would be a little disturbed at the language which requires the Board to be consulted in advance on a considerable number of specific pieces of business.

Senator SYMINGTON. I don't think the bill requires that the consultation be made from the standpoint of their having any authority.

It is simply to consult and advise with them before making a decision without the Board's having any decisive authority.

Isn't that correct?

Mr. PRICE. Perfectly correct, Senator; and to my mind that saves it from being a handicap of any seriousness.

And if this language seems wise in order to make the transition from the NACA to the present Agency desirable, I certainly wouldn't think of advising a change in it.

The director, if he is a wise man, would actually consult with the Board a great deal more than this suggests; but when the emergency comes, I think it is sometimes quite unwise to have that kind of a requirement pinned down in language. But, as it is put here, I don't think the requirements is likely to be a serious difficulty.

Now, the third general point I would like to comment on very quickly is the relation of the new agency with the rest of the Government. Part of this will involve international affairs, where the Department of State is bound to be concerned. It will involve finance. It will involve almost every part of the Government. I, myself, feel rather strongly that the Government has suffered rather severely in the past 15 or 20 years from the multiplication of unduly formalized systems of interdepartmental coordination. They start out sometimes by being useful, but as they tend to run down in their dynamics and drive, they wind up by being more of a handicap than an asset to the central direction of the executive branch. Therefore, I would hope that this bill would not include any rigid prescriptions as to the nature of the interdepartmental machinery or the liaison with other agencies that should be developed.

I would like to emphasize that I think this agency will have to have very close relations with the military, with the Atomic Energy Commission, and with the State Department, and on the most important issues will be tied right into the Presidency. But I think those relationships will be more effective if the lines of interdepartmental communication aren't cluttered up by unduly rigid statutory procedures of coordination.

I think I would do well to stop at this point, Senator. I would be happy to answer any questions that may occur to you.

Senator SYMINGTON. Thank you, Mr. Price.

Senator McClellan, do you have any questions?

RELATIVE MERITS OF A SINGLE DIRECTOR OR A COMMISSION FORM OF ADMINISTRATION

Senator MCCLELLAN. When I asked one previous witness, he favored the Commission approach to administration rather than having a director. What is your position with respect to that?

Mr. PRICE. On that, Senator, I'm afraid that I am just a little old fashioned. I feel that the leaders of the earliest period of our Government, who started our constitutional system with the idea that a single executive was better than a plural one—I think they were very smart administrators. Unless there is a very special reason for heading an agency with a board, for example, that has truly quasi-judicial activities, I don't think that it is a good idea to have it under a plural head. I think the NACA has long since outgrown the size and stage of development at which a board is an acceptable instrument for directing the job.

Senator MCCLELLAN. If I'm correct, as I interpret this bill, the real power and the final authority of decision is vested in the Director.

Mr. PRICE. That seems to me correct, as I read it, sir.

Senator MCCLELLAN. The Board is advisory only. The Board might be unanimous with one viewpoint, and the Director could disregard that and make a decision independent of the Board's counsel and advice. I'm not arguing the question, but that is placing a great deal of authority in one man, is it not?

Mr. PRICE. Yes, sir; but I think that is the only way you get responsibility. I think if a director took that line over any period of time and on issues of any importance, the head of the executive branch of the Government would then have to decide what he was going to do about the matter. I cannot imagine that situation persisting very long without the matter being settled by one side or the other.

Senator MCCLELLAN. Do you favor the Director's being appointed for an indefinite term?

Mr. PRICE. I would favor his being in that position with exactly the same tenure of office as any other administrator or Cabinet member; that is to say, removable by the President at a moment's notice.

Senator MCCLELLAN. In other words, the Director, once appointed and confirmed, could only be removed by the President or, of course, by impeachment.

Mr. PRICE. Yes, sir.

Senator MCCLELLAN. Do you think that measure of personal security and feeling of authority and so forth is essential to his job? In other words, he goes in there thinking, "Well, now, I have the authority, I can do it; as long as I please the President, why, I'm the boss."

Mr. PRICE. It seems to me, Senator, that is the only way to get the kind of responsibility you need in this kind of a job. This isn't very much personal security, as I look back over history.

Senator McCLELLAN. I meant security in his position, not in a financial way.

Mr. PRICE. Not in his job.

Senator McCLELLAN. No; I appreciate that. But a lot of folks take a great deal more pride in the acquisition, if I may use that term, of authority and power than they do, necessarily, in financial gain.

I'm not arguing the question. I'm just trying to evaluate here what we are doing and, if the circumstances, the world conditions, the challenges that confront us, and the emergency are such as to warrant our taking this very—I regard it as a very unusual, extraordinary course of action. Maybe they do. I'm not saying that they don't. I want to weigh it in that light.

Mr. PRICE. I think the considerations you have outlined, Senator, are very important ones. It seems to me that here, if the present state of world affairs warrants the setting up of this kind of agency at all, it warrants setting it up on the basis where the head of the Agency is in a position to be one of the leading figures in the total executive councils of the President. I think the record, generally, shows that if a man is serving as an executive under a Government board, it is impossible for him to pull any real weight in the President's inner councils.

Now, I don't think that this would lead me to say that this bill ought to prescribe that the head of this Agency should have Cabinet rank or sit in the Security Council. I think that kind of provision is unwise in legislation. But I think, if this man is of the stature he should be to do the job, the President ought to want to have him frequently at his elbow, and present at meetings when the fundamental policies of the Government dealing with new scientific and security and educational developments are being considered.

Senator McCLELLAN. Well, in this area that I have been interrogating you about, I may go along, and I may very well, and wisely, I think, defer my own personal wishes to the judgment of those whose counsel I am confident I can rely on. But I do feel we are taking a very far-reaching step. It may be fully justified; it may be imperative. Thank you, sir.

IMPORTANCE OF PUBLICIZING DIFFERENCE BETWEEN AMERICAN AND SOVIET SATELLITES

Senator SYMINGTON. Mr. Price, you have had a great deal of experience in the administrative side of government, as I can see from reading your record, and you have been interested in Government organizations, as I gather from your book. A lot of your work has been in the Department of Defense and the Research and Development Board. Were you here when Dr. Pickering testified?

Mr. PRICE. Yes sir; I was.

Senator SYMINGTON. Don't you think we ought to do something about alerting the American people to the difference between our satellites and the Soviet satellites?

Mr. PRICE. Well, on this, you have me out of my depth, Senator. I am a layman in these matters, and I have only a layman's opinion. But, as a layman, my answer would be, certainly, "Yes."

Senator SYMINGTON. You are a layman, but you are also a newspaperman of considerable experience, and you have also been in the

Government. Dr. Pickering points out that our satellites mean nothing, from the standpoint of a possible weapon, while as for their satellites, it has been proven conclusively that they have the thrust of an ICBM. I believe that he said in his testimony that the feeling of the people back home, where he comes from, and I think it is also fair to say that of the people where I come from, is that the score now is 3 to 2. But the things being counted are not the same, and yet the people don't seem to realize that.

What would be your thought as to how that could be clarified in the minds of the people? I base that question on the premise that, if the people are alerted to the danger, they will be more willing to sacrifice to meet it.

Mr. PRICE. Well, Senator, I don't see any way other than by the accommodation that always has to take place between the leadership of the President and the Secretary of Defense, on the one hand, and those Members and committees of the Congress, on the other, who also have an interest and responsibility in this field. I would have to confess, in answer to your question, that I have been alarmed about the comparative state of our weapon developments in certain fields, and I do not think this is adequately taken into account, either by the current defense budgets or the support for certain parts of defense technology.

COMPARISON WITH DEFENSE REORGANIZATION PLAN

Senator SYMINGTON. Haven't you been interested in the President's defense reorganization plan?

Mr. PRICE. Yes, sir; I have been personally interested, and as an informal consultant. I was staff director of the 1953 Committee on Department of Defense Organization. Since then, I have tried to keep up with the subject as an outsider, but I haven't had any formal responsibility in the matter.

Senator SYMINGTON. Do you believe that this bill reflects the aims and objectives that are outlined in the reorganization bill? That is, location of power and responsibility together?

Mr. PRICE. I do. I don't see anything incompatible between this bill and the recommendations that have been made with respect to the Defense Department reorganization this year at all.

Senator SYMINGTON. Thank you very much, Mr. Price. We appreciate your having given us the benefit of your views this morning.

Mr. PRICE. Thank you, sir.

Senator SYMINGTON. Our next witness this morning is Dr. Harry Wexler, Director of the Office of Meteorological Research.

Dr. Wexler, you are here to testify about a field which has extremely important potentialities.

We consider you a very important witness and we are looking forward to your testimony.

I am asking unanimous consent to insert in the record a biography setting forth your experience and qualifications.

(The biography referred to is as follows:)

BIOGRAPHY OF DR. HARRY WEXLER, DIRECTOR OF METEOROLOGICAL RESEARCH OF THE UNITED STATES WEATHER BUREAU

Dr. Wexler was born in Fall River, Mass., on March 15, 1911. He received a bachelor of science degree from Harvard in 1932. He did graduate work at MIT and obtained his doctor of science degree in 1939.

He was a meteorologist with the United States Weather Bureau from 1934 to 1940, 1941 to 1942. He was assistant professor of meteorology at the University of Chicago, 1940–41. He served as a meteorologist with the Air Force, 1942–46, attaining rank of lieutenant colonel. In 1946 he returned to the United States Weather Bureau and was made Director of Meteorological Research in 1955.

He has been active on a number of IGY panels including the United States Expedition to the Antarctic as chief scientist. He is a member of the National Academy of Sciences and a subcommittee of the NACA. He is a fellow in the American Academy of Arts and Science, a member of the American Geophysical Union and the Royal Meteorological Society. He has published more than 50 scientific papers on meteorology.

Senator SYMINGTON. You may proceed with your statement.

STATEMENT OF DR. HARRY WEXLER, DIRECTOR, OFFICE OF METEOROLOGICAL RESEARCH, UNITED STATES WEATHER BUREAU

Dr. WEXLER. Thank you, Mr. Chairman.

I am sorry that I don't have a prepared statement to make, but I just arrived from an out-of-town trip last night.

Since I have been living with this subject now for 4 years, I believe I can speak off the cuff.

We meteorologists can be compared to creatures living at the bottom of a vast ocean of air and trying to surmise what is happening above our heads by sending up balloons with instruments attached to tell us the pressures, the currents, the temperatures, and so on. We try to piece together the information to see what is happening to this ocean of air and make predictions for the welfare of the people.

The comparison might be drawn further: that over this ocean—for the time being, let's consider it a liquid ocean—we have an airplane flying which obtains a bird's-eye view of currents, waves, and other phenomena that can be seen at one snapshot and which can then be interpreted in terms of storms, and weather in this vast ocean.

Well, what we meteorologists would like to do is get above this ocean of air and to observe the storms by means of the cloud cover.

From the cloud cover, a very distinctive signature of storms, we can deduce the size of the storms, the nature of storms and their motion.

Only about one-fifth of this vast ocean of air is adequately probed by means of balloons and other instruments sent up aloft from the bottom of this ocean.

The large oceanic areas, the North Pacific and the North Atlantic, are inadequately probed by observations.

The polar regions have, even during this period of the International Geophysical Year, a rather sparse network.

The vast areas of the Southern Hemisphere, which is predominantly oceanic, have very few observations.

We do not know the answers to outstanding weather problems; for example, what caused the end to the prolonged dry cycle of weather in the Southwest and formed the current wet period.

We try to piece together the scattered bits of information that we do get, but they cover less than one-fifth of the total mass of the atmosphere.

We would like to have a vehicle which is comparable to the global coverage of the atmosphere to give us an overall picture of what is happening, which we need in order to make better forecasts.

A satellite vehicle offers for the first time an observing platform commensurate with the global scale of weather.

The problem of observing the weather by the satellite is one primarily of observing the cloud cover and identifying storms in terms of cloud cover.

But the satellite vehicle offers something more than just a means of observing clouds and interpreting them in terms of storms.

Adequately equipped satellites which will actually be sent up during the International Geophysical Year will also give us a measure of the useful energy received from the sun, which, in the final analysis, drives weather.

Weather forms from the ceaseless attempt by the atmosphere to compensate the unequal heating from the sun. The atmosphere receives too much heat at the equator, too little heat at the poles. In trying to equalize this heating, wind and weather are created.

If we can keep an accurate bookkeeping account of the amount of energy received from the sun, part of which is reflected by the clouds, part of which is absorbed by the atmosphere, but most of which is absorbed by the ground, and, if we can also measure the outgoing energy which the earth sends back to space, then we can find out how much fuel is coming into this heat engine of ours, which drives the atmosphere and creates weather.

In recognition of these principles, two International Geophysical Year satellites will be equipped with instruments: one to measure the cloud cover, and the second to measure the energy balance which we need to find out how much fuel drives the engine.

This is merely the beginning, however. We think that by the development of improved instruments, we can measure other properties of the atmosphere, such as temperature, winds, total amount of water in the atmospheric columns, so necessary for precipitation forecasts, and other important properties that cannot be undertaken during the present short International Geophysical Year.

For the past 4 years the Weather Bureau has been studying this problem of making use of satellites in weather observing and prediction, and it looks forward with a good deal of anticipation to a remarkable advance in our knowledge of the atmosphere and its ways, and the ability to predict more accurately, not only the day-to-day weather but even longer range weather, once we are able to survey globally the atmosphere.

Senator SYMINGTON. Thank you, Dr. Wexler.

Senator McClellan, do you have any questions?

RAMIFICATIONS OF BETTER WEATHER PREDICTION

Senator MCCLELLAN. Dr. Wexler, do you agree that weather control may have considerable military significance?

Dr. WEXLER. Yes, Senator, I believe weather control can have significance in any form of human activity. This would include the military application as well.

Senator McCLELLAN. Then it might be very vital in a military operation, if one adversary had the information and the other did not?

Dr. WEXLER. Yes, sir; that is correct.

Senator McCLELLAN. If, as a result of space research, it became possible for man to reliably determine weather conditions, as you say, at any point on the earth's surface, would you consider that as a means by which such control as was exercised should be defined as military, or would you define it as civilian?

Dr. WEXLER. Well, sir, it seems to me that if a weather control system could be devised, it would have ramifications in all activities.

Agriculture would be a very obvious application; transportation, and, of course, as for any improvement in technology, there are almost inevitably military applications.

In working very closely with military meteorologists and, in fact, during the war, I served 4 years as a military meteorologist, which was inadvertently omitted from my biography, I can say without any hesitation that both military and civilian meteorologists need essentially the same body of information. Once they have received that, the uses to which they put it depend on what they are trying to accomplish.

Senator McCLELLAN. Would you say the military or civilian need for this information predominates?

Dr. WEXLER. This is very difficult to answer. It is like asking whether you need your heart more than your lungs. It is impossible to give a preferential answer to that.

Senator McCLELLAN. Then do you think that if we could dispense with the military need completely, there would still be justification from the civilian standpoint?

Dr. WEXLER. Yes.

Senator McCLELLAN. If we never needed it for another war, if we never needed it for that purpose, the need for this exploration and acquisition of the information that we hope to get would still persist for civilian purposes, for the whole human race?

Dr. WEXLER. That is correct, Senator.

WEATHER BUREAU REPRESENTATION ON BOARD

Senator McCLELLAN. As the spokesman for the United States Weather Bureau, do you feel that the Bureau should be represented on this Space Board?

Dr. WEXLER. Very definitely. I think that we have a real, immediate interest and stake in this satellite, and we would like to insure the placing of suitable meteorological instruments upon the satellites that will be launched during the next several years, and in fact, indefinitely.

Senator McCLELLAN. If representation is not given to the Weather Bureau on this Board, would you feel that its importance is being relegated to a position that is less than it deserves?

Dr. WEXLER. No, sir. I think this would be a rather adequate representation if we had one member on the Board.

Senator McCLELLAN. I say that if it is not given that recognition and placed on the board, would it not be, in your judgment, relegating it to a position of lesser importance than it really deserves?

Dr. WEXLER. Yes, sir; it would.
Senator MCCLELLAN. Thank you, Mr. Chairman.

FUTURE POSSIBILITY OF WEATHER CONTROL

Senator SYMINGTON. Dr. Wexler, do you think that we are going to be able to control weather from the standpoint of agriculture fairly soon?

Dr. WEXLER. This is a very difficult question, Senator. I think we are arriving now at a point in our technology where we are beginning to have energy sources available to us which are commensurate to some degree with some of the minor atmospheric storms. Parallel to this availability of energy sources, we are learning a lot more about how the atmosphere operates. I think the time is coming when we will know more about how the atmosphere operates and here the satellite will certainly give very vital data, so that we may be able to select those weak spots, those Achilles heels in the atmospheric cycle where, with application of our relatively puny sources of energy, even with the megaton weapons and nuclear energy sources, we might perhaps exert an influence along beneficial lines.

There is a good deal of thinking going on about this. In fact, I have read recently a translation of a speech, given in the Pravda last December by a Soviet scientist whose name is Eugeny——

Senator SYMINGTON. It is pretty clear this morning that they are ahead of us in missiles. You don't mean that they are ahead of us in weather, too?

Dr. WEXLER. No, sir. I am trying to indicate that people are thinking along these lines, and Eugeny Feodorov, who was formerly head of the Soviet Hydro-Meteorological Service and now head of their satellite project, proposed that the nations of the world get together in a sort of new International Geophysical Year effort to see about controlling weather along beneficial lines. I mention this not to say that this is a serious proposal, but that there are people thinking about these things, because they are aware of the fact that we are not too far from this goal.

Senator SYMINGTON. Getting together would be constructive, don't you think? It might help break down the Iron Curtain, at least.

Dr. WEXLER. Well, Senator, meteorologists have been together for at least a century. Even during the worst of the cold war, there was full exchange of weather information across the Iron Curtain. Both sides of the Iron Curtain realize that they must have this information in order to carry out their forecasts in service to the public.

This is a rather rambling answer to your question, but there is no question in my mind but that weather control of some sort will emerge. I don't think it will be rapid. We have to learn a lot about the atmosphere. I think it would be very dangerous, indeed, to engage in experiments in the atmosphere without more confidence of what may happen. We may try something that we think would be beneficial, but it might turn into a disaster.

I have in mind as an example that proposals have been made to hasten the melting of the Arctic icepack, which has been melting for the last 20 years, anyway, although slowly. If we could by some means hasten the melting of the Arctic icepack, this would not raise the ocean surface, as has been mentioned as a possibility, because this

is floating ice and would not change the volume of water. But it would give you an open source of water in the wintertime, which would increase the frequency and intensity of the snowstorms in the coastal regions around the Arctic, and might begin a minor ice age. In fact, such a theory of ice ages has been proposed recently by Professor Ewing of Columbia University. He believes that if the Arctic Ocean were open, it would provide additional moisture which could be deposited in the form of heavy snow and in time create large continental ice masses.

If we are looking now for the establishment of milder winters by eliminating the icepack, we might possibly cause disaster by building up over decades large ice sheets in the communities around the Arctic Ocean. These things have to be examined very carefully.

Senator SYMINGTON. Thank you, Doctor. As you know, farmers are becoming more interested in this. Senator McClellan's State and mine have been visited by very bad droughts in 1953, 1954, 1955, and 1956, and then last year, by heavy rainfall.

Dr. WEXLER. Yes, I know.

WEATHER BUREAU COOPERATION WITH OTHER AGENCIES

Senator SYMINGTON. We appreciate your testimony, Dr. Wexler. I would like to ask one more question.

We have had some testimony here about the National Science Foundation being a better place than the NACA or this contemplated new agency, the NASA, for handling meteorological studies. What do you think about that?

Dr. WEXLER. Well, sir, this is a little bit out of my field of weather prediction. All I can say is that the Weather Bureau has worked harmoniously with both these Agencies.

Senator SYMINGTON. Thank you very much. We appreciate having the advantage of your testimony.

Our final witness today is Dr. Richard Van Wagenen, dean of the Graduate School of American University.

Dr. Van Wagenen, I understand that you are appearing here today on behalf of the American Association for the United Nations. We are very much interested in having the benefit of your advice and counsel.

I am asking unanimous consent to place in the record a copy of your biography.

(The biography referred to is as follows:)

BIOGRAPHY OF DR. RICHARD W. VAN WAGENEN, DEAN OF GRADUATE SCHOOL, AMERICAN UNIVERSITY

Dr. Van Wagenen was born in Denver, Colo., in 1912. He received a bachelor of arts from Stanford University, a master of science degree from Syracuse University, and a doctor of philosophy degree from Stanford University.

He was with the New Hampshire Foundation in 1935, the Council of State Governments from 1935 to 1937 and the Pennsylvania Economy League from 1937 to 1938. He was a teaching assistant at Stanford University 1938 to 1941 and an instructor at Yale University from 1941 to 1942. From 1942 to 1947 he served in the United States Army attaining the rank of lieutenant colonel. He was an associate professor at Duke University from 1947 to 1950 and a visiting associate professor at Columbia University from 1949 to 1950. He was director of the Center for Research on World Political Institutions at Princeton University from 1950 to 1957 and a member of the civilian faculty of the National War College from 1956 to 1957. He was appointed dean of the Graduate School and professor of international relations at the American University in 1957.

He is a member of the Commission to Study the Organization of Peace, the American Political Science Association and other professional organizations. He has written many publications on international relations.

Senator SYMINGTON. The committee is ready to receive your statement, Doctor.

STATEMENT OF RICHARD W. VAN WAGENEN, DEAN OF THE GRADUATE SCHOOL OF THE AMERICAN UNIVERSITY

Dr. VAN WAGENEN. Thank you, sir. First, I want to say that I am representing the position of the American Association for the United Nations, and not that of the American University, which has no position on this matter. I have never been a member of the American Association for the United Nations, but have been, and am, a member of its research affiliate, the Commission To Study the Organization of Peace. It is mainly from the tenth report of the commission, published last fall, that I speak. For the record, this book is entitled "Strengthening the United Nations," by Arthur N. Holcombe, published by Harper & Bros.

The American Association for the United Nations is an educational organization, and takes no position on legislation. Therefore, we express no opinion concerning the bill which is before you. This does not prevent us, I hope, from congratulating Senator Johnson upon the depth of his interest in matters of outer space.

The bill before you contains a mere reminder of the primacy of the international aspects of this problem of controlling outer space. We must not forget that, while we may already be a little way into the space age, we are—and have been for a very long time—deeply into the international age. We believe that, by all means, we should be sure that we do not slip back into the isolationist pattern just when a new frontier is about to be opened.

Indeed, the position of the AAUN is that the security of the United States, which is now inseparable from the security of a large part of the world, would be enhanced by international control of outer space. Certainly the United States, powerful as we are, cannot control outer space by ourselves. Therefore, we must think of any space agency that may be created for handling this problem in the United States, as connected somehow with similar agencies of other countries. To put our position in briefest form, it is that space is a global problem, if ever there was one—by definition—and that it should, therefore, be handled by as close to a global political agency as may be developed.

When I use the terms "handle" and "political," of course, I am implying the need for some kind of control over this new area by society, through some kind of agency. If we each claim this new territory, what would have been squabbles in the distant past may, very possibly, be fatal acts of national destruction in the present day. To whom does outer space belong? Shall we fight in order to find out? We believe that it would be better for the United Nations to declare that this area, which is now outside the jurisdiction of any nation or group of nations, actually belongs to the international community.

This does not mean that we believe the United Nations should handle all aspects of the problem, nor does it mean that agreements ought not be reached outside the U. N. To us, the analogy of the

high seas points the way, to some extent. So does the Antarctic Continent. But I shall have to skip over that point because of time limitations. But we see no reason why both Antarctica and outer space cannot be owned by the United Nations as the nearest thing we have to a representative of the so-called international community. We recognize the value of other proposals, such as internationalization by a few nations. These may be, by all odds, the most practical first steps.

QUESTION OF RED CHINA

Senator SYMINGTON. Let me ask you a question there to clarify my own mind. What would you do about Communist China, which is not a member of the U. N., if they started their own independent unit? I'm not trying to pin you down; I'm just asking for my own information.

Dr. VAN WAGENEN. We didn't cover that.

Senator SYMINGTON. They are getting their own scientists, and getting interested in other aspects of world affairs. If the United Nations controlled it, that would mean Red China had no rights in it.

Dr. VAN WAGENEN. Yes, sir. I think they also would have no obligations, which is a point for worry.

Senator SYMINGTON. Yes. Please proceed.

Dr. VAN WAGENEN. We would welcome any beginnings of agreement on international inspection, for instance, however limited they might be. Full control of armaments, under proper safeguards, is the objective which, I think, almost all of us have in mind. But we think that, if this can be done in connection with the United Nations, or if the results can be attached to the U. N., we will gain a priceless dividend for the future. We will be strengthening an organization which can, by being stronger, meet other international problems that may arise in the future. As we said in the foreword of the tenth report:

> Our program calls for moving forward in what we believe to be the right direction at as fast a pace as fits the spirit of the times and the temper of the nations (p. xi).

We recognize the overriding importance of national policies, as distinguished from international mechanisms, in world affairs today. It is debatable whether there is an international community today sufficiently developed to succeed fully in controlling activities in outer space. And few people would want these activities controlled, provided they could be assured that they are peaceful activities. But it takes considerable powers to insure that they are peaceful. It would be a bold step, but not too bold for the times, to put the United Nations in the middle of this picture. I do not presume to say whether the eminent chairman of this space committee of the Senate would support all of our recommendations, but we certainly support him in his broad proposal, stated last January and February in such ringing terms, that exploration of outer space be undertaken by the United Nations to make this territory "an outpost of peace." He said the time to act was now, "while the satellites are searching for facts instead of targets," and we agree with him that "here is an opportunity to bring men together in common cause as never before." Senator Saltonstall, another distinguished member of this committee, has also

expressed the hope that the first steps "may be taken through the United Nations."

We do not advocate, of course, that the United States give up its activities in the race for supremacy in outer space until thoroughly reliable agreements can be reached. We have had too many bad experiences with the Soviets. We recognize that the United States is engaged in a global struggle with the Soviet Union and that the innocent earth satellites of the present day will become highly dangerous instruments of destruction in their future forms. If it would seriously threaten our security to bring the United Nations closer to the center of this problem, naturally we would not, as you would not, advocate any such move. We insist upon the fundamental significance of power, whether national or international. We feel that by bringing the United Nations into the center, we are contributing to the long-run security of our country by acting boldly as soon as possible.

We do not advocate placing ownership of space vehicles in the United Nations unless and until a thoroughgoing system of international control over armaments is established. To do so would not seem to be politically wise or practicable. Rather, we advocate five things at present:

1. That the principle should be accepted that outer space is not subject to ownership or control by individual states, but only by the international community, represented by the United Nations. This means that the United States delegation should press this principle in the General Assembly.

2. That international ownership and operation of all or certain types of spacecraft be adopted as the long-run goal of United States policy in this field.

3. That international registration of spacecraft and verification of flights be adopted as the short-run policy of the United States regarding earth satellites only.

4. That the missile which is designed to travel in outer space, but not in an orbit, should be treated as any other piece of armament. It would therefore be handled by any program of arms control that may result from current and future international discussions.

5. That the international agency administering the registration, inspection, and verification function recommended here should be a branch of whatever international body may be agreed upon to carry out arms control as a whole, and should share in the powers of enforcement granted to that body.

Finally, we cannot repeat too often the fact that to support—even to strengthen—the United Nations is good clean official United States policy of long standing. President Roosevelt fought it through a very willing Senate. President Truman put the United States more solidly behind the United Nations than ever; it is sometimes forgotten that point 1 of his famous point 4 speech was "unfaltering support of the United Nations." Leading Senators of both parties, from Arthur Vandenberg and Tom Connally onward, have seen the United Nations as an asset to the United States. The list includes some of the most eminent Members of the present Senate and, indeed, several members of this committee.

President Eisenhower I believe stands in the same position, and it was only last January when he wrote, in one of his letters to the Prime Minister of the Soviet Union:

> I propose that we strengthen the United Nations. This organization and the pledges of its members embodied in the charter constitute man's best hope for peace and justice.

His proposal earlier this month that 12 nations, including all the "Big Five" except China, meet this year to agree upon internationalization of Antarctica, was a forward step. Even though the United Nations was not proposed as the vehicle for reaching the agreement that he believes these nations ought to reach, there are no doubt perfectly good reasons for this and they do not foreclose an agreement which would bring this territory under the jurisdiction of the U. N. for the peaceful purposes the President foresees.

Shouldn't we do much the same thing with outer space—so different in degree but not in kind? There are some people in this country who would like to push the United Nations itself into outer space and leave it there. The American Association for the United Nations, on the contrary, urges putting outer space into the orbit of the United Nations, for the protection of ourselves as well as other nations.

That, sir, is all I have as a statement.

Senator SYMINGTON. Senator McClellan, do you have any questions?

Senator MCCLELLAN. I have no questions, Mr. Chairman.

Senator SYMINGTON. In my opinion, this is a very constructive document that you have presented. In some way, we have to get a brotherhood of man in this nuclear age, or else we are all going to end up under the domination of a particular group who consider that the citizen is a servant of his state, instead of its master, or we are going to be eliminated from the earth entirely.

Thank you very much, Doctor. We appreciate having the advantage of your testimony, and we are grateful to you for coming down.

Dr. VAN WAGENEN. Thank you, Senator Symington.

Senator SYMINGTON. Without objection, I would like to ask permission of the committee to include in an appropriate place in the committee hearing record certain letters received from Government officials, and statements submitted by interested persons and groups on the subject matter of these hearings.

(The material referred to appears in the appendix.)

Senator SYMINGTON. The hearing will now adjourn, subject to the call of the Chair.

(Whereupon, at 12:05 p. m., the committee adjourned, subject to the call of the Chair.)

APPENDIX

DEPARTMENT OF COMMERCE,
THE GENERAL COUNSEL OF COMMERCE,
Washington, D. C., May 21, 1958.

Hon. LYNDON B. JOHNSON,
Chairman, Special Committee on Space and Astronautics,
United States Senate, Washington, D. C.

DEAR MR. CHAIRMAN: * * *

As you know, the Chief of the Weather Bureau, Dr. Reichelderfer, was unable to be present to testify because of the change in the committee's schedule. Dr. Reichelderfer has since returned from Europe and has prepared the attached statement, which he would like to have included in the committee's record.

We appreciate the opportunity we have had to help the committee in its deliberations, and if there is any other material which we could supply, please let us know.

Sincerely yours,

J. ALLEN OVERTON, Jr.,
Deputy General Counsel.

STATEMENT OF DR. F. W. REICHELDERFER, CHIEF, UNITED STATES WEATHER BUREAU

In his testimony before this special committee, the Chairman of the NACA, Gen. James H. Doolittle, referring to use of satellites and space platforms has stated that "one of the most obvious, and immediately valuable (uses) has to do with meterology." This statement is well supported by facts already known. In fact, one is justified in going much further with reference to the significance of artificial earth satellites in exploring the atmosphere to discover and measure those elements and features which are all-important to a full understanding of weather and climate. Not only is a full understanding necessary to accuracy in predictions of weather conditions, it is also indispensable to intelligent development of weather modification and control, whatever their practical possibilities may be. Certainly, the practical possibilities of weather control are still unknown and they can be brought out only by better understanding of the complex interrelationships between the energy from the sun, the heating of the atmosphere and the many feedbacks involved in the atmospheric mechanisms which produce weather and climate. This is not the place to go into detail as to the possibilities and the consequences of various forms of weather control. It is sufficient to say that while there are many problems in meteorology still to be solved, we may be sure that there are consequences of weather control which must be reckoned with. We know that there are some possibilities which would turn out to be cases of a cure worse than the disease.

I do not imply that meteorological observations of the atmosphere and its cloud systems viewed from above by means of telemetering devices on artificial satellites would solve all meteorological problems of weather prediction and "control." Even with the benefit of continuous monitoring of storm development as seen from the top of the atomosphere, it will still be necessary to develop and improve our system of observations of what goes on within the atmosphere, particularly within the troposphere where most of the severe storms are formed. One small illustration will show the value of observations from a satellite. About 4 years ago a photograph was made available to us by the Office of Naval Research showing the cloud systems over Texas and other Southwestern States and part of the Gulf of Mexico, as viewed from an altitude of about 100 miles by means of a camera carried aloft by a V–2 rocket from White Sands. This picture gave meteorologists their first information that a veritable hurricane had developed at a height of 1,500 or 2,000 feet above the ground. The network of weather observations on the ground and the data from upper air sounding balloons had been

insufficient to identify the existence of this cyclone aloft. It accounted for heavy rains that could not be explained from data normally available. No one knows how frequently there are significant and often determining factors in the circulation of the atmosphere that escape detection in observations made from the surface of the earth. This photograph from a rocket shows vividly and conclusively how much more we would know about the atmosphere if we had continuous pictures of the clouds telemetered from the satellite above the "top" of the atmosphere.

There are meteorological elements other than clouds that can be measured accurately by means of artificial satellites and other devices for exploring the outer atmosphere. For example, variations in the intensity and spectrum of radiation from the sun may have an important influence on atmospheric circulation and the weather. Changes in the ozone content at high altitudes would doubtless modify the "greenhouse" effect on the radiation balance in the earth's atmosphere and this could cause great changes in weather and climate. There are still other meteorological features.

In the past weather and climate have often been taken for granted. Their determining role in human affairs may be overlooked except when extremes of drought or flood, cold wave or prostrating heat or destructive storms upset the entire economy of a region or a locality and cause heavy loss of life and property damage. The importance of weather in military operations should also be remembered. Even in modern times the outcome of many a military engagement has depended in large part upon weather conditions and in the past the course of history has more than once been changes as result of "defeat" caused by storms rather than by opposing military forces.

There can be no doubt that the science of meteorology is at the threshold of important developments. Advances in the technology of electronics, etc., have opened up possibilities never available to the meteorologist before. The frequent inadequacies of weather forecasts are well known but these are not due to indifference or inaptitude on the part of the meteorologists; they are due to lack of basic data of meteorological elements and to still inadequate techniques for treatment of larger volumes of data. But the solutions to these problems are in sight. The research and the facilities visualized under the legislation now being considered by your committee are among the essential steps toward keeping the United States in the forefront in meteorology and its applications in weather prediction and weather modification or control. In my opinion, the establishment of a civil agency in the proposed NASA is the best way to advance our capabilities in aeronautics and space exploration in the outer atmosphere and in the many aspects related to other fields of science, such as meteorology.

FEDERATION OF AMERICAN SCIENTISTS,
Washington, D. C., May 13, 1958.

Hon. LYNDON B. JOHNSON,
Chairman, Special Committee on Space and Astronautics,
Senate Office Building, Washington, D. C.

DEAR SENATOR JOHNSON: We wish to call to your attention the enclosed statement of views on space research and development, authorized by our national council at its annual spring meeting here on May 3. The council is the governing body of the FAS.

We urge the committee to consider the council's views and hope that the complete text of our statement can be included in the printed record of the hearings now being conducted by your committee.

Respectfully yours,

AUGUSTUS H. FOX, *Chairman, 1958–59.*

TEXT OF STATEMENT ON THE NEED FOR A CIVILIAN SPACE AGENCY IN THE UNITED STATES AND FOR AMERICAN LEADERSHIP TO FOSTER INTERNATIONAL COOPERATION IN THIS FIELD

(Authorized by the national council of the Federation of American Scientists at its meeting in Washington, D. C., May 3, 1958)

The imagination of men everywhere has been fired by the recent satellite launchings, which have taken us across the threshold to outer space. The opening of this new area of technology poses a challenge to United States planning as profound as the advent of atomic energy in 1942. That challenge was met by Congress

through passage of the McMahon Act, establishing a completely civilian commission to direct the atomic-energy program.

Legislation of comparably creative character is required to realize the potential benefits of the space age. Although the initial development of atomic energy was under the Manhattan project, the Congress wisely placed the permanent responsibility for its direction in civilian hands. Under this leadership, the military uses of atomic energy have been energetically pressed. Moreover, both military and civilian uses of atomic energy have prospered in an atmosphere more conducive to scientific progress than that typically available under military direction.

Mindful of this precedent, and of the failure of the Pentagon leadership to foresee the impact of the first satellites in the popular imagination, we urge immediate establishment of a civilian space agency. This organization should be entrusted with full responsibility for the conduct of space research and development of space vehicles. Suitable provision should be made for the transfer of appropriate existing research projects to the new agency.

We further urge that the Congress prepare to seize the opportunity for American leadership in this frontier area by fostering international cooperation in space research and exploration. We can best improve our national security by initiating cooperative programs which will draw together the peoples of the world in the joint conquest of outer space. It would be tragic if the challenging task of space exploration were carried on in the competitive nationalistic pattern under which it has begun.

The general armaments race has now produced a perilous stalemate which it is in the interest of no nation to continue. Mankind now faces a choice between increasing this peril by militaristic space conquest or relaxing world tensions through the cooperative peaceful exploration of space.

Travel to the moon and beyond must now be faced in its political aspects. We look with disfavor on the developing race to establish national bases on the moon and on the planets. We would much prefer to think that men, divided though they have been on their own planet, can at last unite in the inspiring task of exploring the universe. We do not wish to see the satellites of Mars or Jupiter become satellites of the Soviet Union or possessions of any other country. We think that a united and coordinated international effort should be attempted under the authority of the United Nations. We therefore urge that the Congress prepare the way for this international effort by placing our space program under a truly civilian agency which can serve the national security and interest in the broadest sense.

The Problems of Congress in Formulating Outer Space Legislation [1]

(By Eilene Galloway, special consultant, Senate Committee on Space and Astronautics)

I. THE NEW FRONTIER

The successful launching of an earth satellite by the Russians on October 4, shortly followed by a second and much heavier sputnik on November 3, 1957, was a dramatic announcement to the world of scientific progress which opened up new realms for man's exploration of outer space. While the United States was caught unawares by this evidence of Soviet mastery of science and technology, it was not far behind in sending its Explorer into orbit on January 31, 1958.

The repercussions of this situation upon the Congress can only be understood in the context of the extreme complexity of outer space exploration and control. A basic knowledge of science and technology is required in order to determine the relationship of outer space development to national and international law, national defense, foreign relations, education, communications and navigation, weather control, medical research, and the organization and administration of the Government for handling such a combination of subjects. The scientific facts which can be established at the present time, supplemented by our constant increase in knowledge and experience, are essential to the determination of what is feasible and what is impracticable; of those aspects of outer space which can be adequately covered by a national law and those which will require international cooperative arrangements.

[1] This report was written at the request of Hon. John W. McCormack, chairman, House Select Committee on Astronautics and Space Exploration, March 7, 1958, by Eilene Galloway, national defense analyst, Legislative Reference Service, the Library of Congress.

From the outset it was apparent that a breakdown of the total subject of outer space into its component parts resulted in specialized topics which cut across the jurisdictional lines of many committees of the Congress. It was not possible to refer bills concerned with outer space development to one authorizing committee and one appropriations subcommittee for determination. A few hypothetical examples may serve to illustrate both the complexity of the subject and the problem of committee jurisdiction.

The Committees on Agriculture would be interested in new methods of weather control which might be accomplished from outer space. The Committees on Armed Services would expect to consider satellites and their connection with long-range ballistic missiles, particularly propulsion systems and problems of reentry into the atmosphere. The House Education and Labor Committee and the Senate Committee on Labor and Public Welfare would have a vital concern with the education of future scientists, laboratory facilities, and grants-in-aid. The Committees on Foreign Affairs and Foreign Relations would expect to consider proposals for the international control of space, international space law and its effects upon national sovereignty and existing treaties and agreements. The Government Operations Committees might wish to study background information which bore on the various problems of their subcommittees. The House Interstate and Foreign Commerce Committee has already issued a report on the International Geophysical Year as it pertains to the Arctic and Antarctica, and both House and Senate committees could be expected to have a continuing interest in outer-space projects which affected their jurisdiction over civil aviation, communications, weather, and science. Conceivably the Public Works Committees might consider nonmilitary installations, and the Post Office and Civil Service Committees would be interested in proposals for mail delivery by rockets. A number of subcommittees of the Appropriations Committees would receive authorizations, possibly creating the problem of coordination by the full committees. The Joint Committee on Atomic Energy would be concerned with warheads for outer-space weapons, propulsion devices, the reentry problem, arrangements for sharing information with our allies, and any peaceful uses which required atomic energy as a fuel.

The fact that many committees would have a vital concern with various aspects of outer space is only part of the problem. As such, it raises the question of whether we could expect the sum of the parts to result in a total national effort without some form of congressional coordination. But the greatest complication arises when we consider that one segment of the total outer space problem may be of primary interest to several committees simultaneously. For example, weather control could come before the Congress in the form of a bill which could be referred to the Committees on Agriculture, Armed Services, Foreign Affairs, Foreign Relations, Interstate and Foreign Commerce; and if the proposed type of weather control involved the use of atomic energy, the matter could also come within the jurisdiction of the Joint Committee on Atomic Energy.

II. HOW CONGRESS MOVED OUT ON THIS FRONTIER

On November 27, 1957, the Preparedness Investigating Subcommittee of the Senate Armed Services Committee began its "Inquiry into satellite and missile programs." Concluding its first series of hearings on January 23, 1958, the chairman, Senator Lyndon B. Johnson, listed 17 principal areas recommended for decisive action in strengthening our national defense. Hearings concerned with outer space and related problems were also held by both Appropriations Committees, the House Armed Services Committee, and the Special Subcommittee on Outer Space Propulsion of the Joint Committee on Atomic Energy.

On February 6, 1958, the Senate established a Special Committee on Space and Astronautics which was directed to make a thorough study of "all aspects and problems relating to the exploration of outer space and the control, development, and use of astronautical resources, personnel, equipment, and facilities." The committee report to the Senate is due by June 1, 1958, "or the earliest practical date thereafter, but not later than January 31, 1959, by bill or otherwise. * * *" Senator Lyndon B. Johnson is chairman of the 13-member committee.

On March 5, 1958, the House of Representatives established the Select Committee on Astronautics and Space Exploration composed of 13 members with Hon. John W. McCormack as chairman. This committee is "authorized and directed to conduct a thorough and complete study and investigation with respect to all aspects and problems relating to the exploration of outer space and the control, development, and use of astronautical resources, personnel, equipment,

and facilities." The committee report to the House is due by June 1, 1958, or earlier, but not later than January 3, 1959.

To cover the situation in the meantime, the Congress passed Public Law 85–325 which provides in section 7 that "The Secretary of Defense or his designee is authorized to engage in such advanced projects essential to the Defense Department's responsibilities in the field of basic and applied research and development which pertain to weapons systems and military requirements as the Secretary of Defense may determine after consultation with the Joint Chiefs of Staff; *and for a period of one year from the effective date of this Act, the Secretary of Defense or his designee is further authorized to engage in such advanced space projects as may be designated by the President.*"

In passing the supplemental defense appropriation for fiscal 1958 (Public Law 85–322), the Congress approved $10 million in transfer authority for advanced research, and on February 7, 1958, the Secretary of Defense established the Advance Research Project Agency and named Roy W. Johnson as Director. These arrangements make it possible for outer-space projects, both military and nonmilitary, to proceed during the time it takes to formulate permanent legislation for the organization of the executive branch and of the Congress in the handling of outer space problems.

Meanwhile, the President has asked that his scientific adviser, Dr. James W. Killian, Jr., make a study of the kind of organization needed for the future development of outer space.

III. COMPARISON AND CONTRAST OF OUTER SPACE AND ATOMIC ENEGRY AS A LEGISLATIVE PROBLEM

The task of the House and Senate committees in formulating outer-space legislation has been compared to that of the McMahon committee which held hearings and drew up the original Atomic Energy Act of 1946. An analysis of the similarities and differences of these two subjects may provide guidance in our approach to outer space at the present time.

Atomic energy and outer space are alike in opening new frontiers which are indissolubly linked with the question of war and peace. They combine the possibility of peaceful uses for the benefit of man and of military uses which can destroy civilization. Both are national and international in their scope. They involve the relation of science and government, the issue of civilian or military control, and problems of organization for the executive branch and the Congress. If only their similarities are considered, the legislative task would appear to be the easy one of following the pattern of our present atomic-energy legislation.

When the differences between atomic energy and outer space are analyzed, however, it becomes apparent that the present assignment is far more complicated than that which confronted the Congress in 1946. As a source of great power derived from a mineral, uranium, atomic energy can be easily defined and its source can be controlled, its use licensed or prohibited, and there is no legal difficulty in devising penalties against its misuse in a national law. Outer space, on the other hand, is comparable to an unexplored geographic area which is unmapped as far as legal definitions are concerned. We cannot control, license, or prohibit the use of outer space by other nations, and thus there are large areas of the subject which are not amenable to a Federal law. It follows, therefore, that one of the unique tasks of the committee will be to determine the line between those aspects of outer space which can be governed by the United States and those which will require international cooperation. In order to do this it will be necessary first to assemble the scientific facts and to arrive at definitions of outer space which will be acceptable not only within the United States but within the international community of nations. Unless this is done, there is the likelihood that our national law may contain provisions which might prevent us at some later time from participating in some form of international control.

The line between the peaceful and military uses of outer space is much more difficult to draw than is the case with atomic energy. There are peaceful uses of atomic energy which obviously have no military application, e. g., radioisotope research in various forms, particularly cancer research. Practically every peaceful use of outer space appears to have a military implication. For example, the Military Establishment is concerned with weather control, all forms of communication, reconnaissance satellites for mapping; and even medical research on weightlessness has implications for satellite weapons. Thus it is possible for a nation to send up a peaceful satellite for scientific purposes and

to be accused—justly or unjustly—of engaging in this activity for military purposes. If a study of the scientific facts of outer space leads to the conclusion that most if not all exploration yields knowledge which can be used for military purposes by any nation engaged in such activity, then civilian control may be an answer to only part of the total problem. We can establish civilian control within the United States, but if it turns out that peaceful uses cannot be scientifically separated from military implications, then how are we to regulate the international civilian-military situation? Here, again, it will be necessary to ask the scientists precisely how outer space can be controlled for the benefit of mankind and what projects can be devised which will have worldwide acceptance as being peaceful in their nature.

At least one difference between atomic energy and outer space is an advantage rather than a complication. The first use of atomic energy was in the form of bombs used during a war; the first use of earth satellites has been for peaceful purposes. Satellites have not progressed to the point where they are weapons even though their launching devices may be the same as those used for IRBM's and ICBM's. There are 64 nations cooperating in the studies inaugurated by the International Geophysical Year, and since this worldwide effort was started by the scientists themselves, there is room for hope that at least some parts of the IGY program can be continued into the future. Perhaps the scientists and the political scientists will be able to make proposals which will provide for the coordination of national legislation with international arrangements. If some effort is not made along this line, there is danger that this gain in international cooperation may be dissipated.

The existing situation and the time element with which the House and Senate Committees on Outer Space have to contend is more difficult than that faced by the committee which investigated atomic energy in 1946. At that time the war was at an end, the United States had a monopoly on atomic energy and it was possible to take time to formulate legislation without feeling that meanwhile the situation might get out of hand. No other nation was then engaged in atomic-energy development as advanced as that of the present satellite program of the Soviet Union. Atomic-energy information could be classified whereas data on satellites is being shared by agreement among the nations participating in the International Geophysical Year.

Furthermore, the atomic-energy program within the United States was easier to deal with in 1946 than is the case with outer space in 1958. Atomic energy had been developed by one military department and was headed by one man, whereas outer-space programs are now actively under way in three military departments where they have been subjected to a plethora of committees. We now have one director for guided missiles and another for antimissile missiles and satellites. The personnel and facilities for outer-space projects are widely dispersed, and the first nonmilitary development of earth satellites has been the responsibility of military departments. If the people who know how to produce outer-space vehicles are not located in the military departments, they are largely employed by business firms or universities operating under contracts from the Army, the Navy, or the Air Force. It will be a difficult legislative task to devise a law for the effective organization and administration of these far-flung operations in which the military and nonmilitary are so closely associated.

IV. LEGISLATIVE PROPOSALS AND ISSUES

Several bills providing for outer-space development have already been introduced in the Congress, and these combined with the present arrangement whereby both military and nonmilitary programs are the responsibility of the Department of Defense, provide 5 alternative methods for the organization of the executive branch and 3 for the Congress. Additional proposals may be made in the future, but at the present time it is possible to see the large outlines of emerging patterns.

A. Alternative proposals for organization of the executive branch

1. *Development of outer space by the Department of Defense.*—Thus far the United States satellite programs have been conducted within the Department of Defense and will continue there until the Congress makes different arrangements than those now established for the Advanced Research Projects Agency. The fact that this Agency was given responsibility only until February 12, 1959, for engaging in nonmilitary advanced space projects designated by the President suggests that the Congress considered this to be a temporary arrangement to take care of the situation pending further study of the matter. The personnel, re-

sources, and facilities for outer space projects are now located within the Department of Defense, and within the Army, the Navy, and the Air Force, there are teams of people who are already organized to achieve certain objectives. For this reason it may be expected that the advantages and disadvantages of removing outer space from the Pentagon will be strongly presented.

Since the President has already expressed his approval of civilian control of outer-space programs for scientific purposes, and since the Congress has presumably left nonmilitary projects in the Pentagon as a temporary expedient, it seems likely that the main concern will be with the following questions:

(1) Upon the basis of what scientific facts can a line be drawn between military and nonmilitary outer-space projects?

(2) What effective arrangements can be made by a civilian agency for meeting the military requirements of the Department of Defense?

(3) Will the same launching devices be used for military and nonmilitary satellites or will a new civilian agency develop its own equipment?

(4) How shall we divide the limited personnel and existing facilities for outer space development between the Pentagon and a new civilian agency?

2. *Development of outer space by the Atomic Energy Commission.*—This proposal would amend the Atomic Energy Act of 1954 by adding a division of outer-space development to the Atomic Energy Commission. Those who favor this proposal point out that the AEC has been operating successfully for some years in a scientific field which combines peaceful and military projects. It has been able to meet the requirements of the Department of Defense and to advance the peacetime uses of atomic energy in a variety of ways. On the other hand, a question has been raised with regard to the adequacy of the Commission's personnel and facilities for developing outer space. Several questions might be explored in order to estimate the probable repercussions of placing outer space development in the Atomic Energy Commission:

(1) Will it not be necessary to arrive at accepted definitions for outer space before placing the subject in a law which legally defines atomic energy? Will all the provisions of the Atomic Energy Act of 1954 be applicable to outer space and, if not, should a determination be made in advance of all the changes in the law which would be necessary for the legal accommodation of outer space?

(2) If it is decided to remove purely scientific outer space projects from the administration of the Department of Defense, would the transfer of personnel and facilities to the Atomic Energy Commission be any different from their transfer to some other type of civilian agency?

(3) If outer space is not to be administered by the Atomic Energy Commission, how will its work on related nuclear devices be effectively coordinated with the outer space projects of a new civilian agency?

(4) If outer space is to be administered by the Atomic Energy Commission, would it be desirable to change the name of the Commission to correspond to its new terms of reference?

3. *Development of outer space by a new commission.*—This proposal would establish a commission on outer space which would be patterned essentially along the lines of the present Atomic Energy Commission. The possible effects of this proposal may be analyzed by raising the following questions:

(1) How would the relationship between the Commission on Outer Space and the present Atomic Energy Commission be worked out?

(2) Is it possible that the two Commissions might duplicate work on launching devices and propellants for long-range missiles and satellites?

(3) Would the Department of Defense encounter any administrative difficulties in obtaining nuclear warheads from the Atomic Energy Commission and outer space vehicles for the delivery of warheads from the Outer Space Commission?

(4) Would it be practicable and scientifically feasible for the Commission on Outer Space to be primarily concerned with peaceful uses while the Department of Defense retained control over the military uses of outer space?

(5) Since outer space development is closely connected with the conduct of our foreign relations in such a manner as to prevent war, what would be the relationship between the new Commission and the Department of State?

4. *Coordination of outer space program by the National Advisory Committee for Aeronautics working with the National Academy of Sciences and the National Science Foundation.*—Under this proposal or some variation of it, planning and priorities would be undertaken by the National Academy of Sciences, appropriations and construction would be the concern of the National Science

Foundation, while the NACA would coordinate nonmilitary space projects and work in a liaison capacity with the Advanced Research Projects Agency in the Department of Defense.

Those who advocate outer-space development by the NACA emphasize its contributions to aeronautics during the past four decades, the high quality of its leadership, and its production of new research tools, e. g., multistage research rockets and the transonic wind tunnel. Debate on the subject has not shaped up to the point where any disadvantages have been brought to light, and the determination of what would be likely to happen if outer space were given to the NACA would seem to depend upon the evaluation of testimony from expert witnesses. Some of the questions which might be asked are as follows:

(1) Should the total responsibility for outer space development be located in an agency which is primarily scientific and technical?

(2) How would the executive branch of the Government be organized to deal with outer space developments which affected the conduct of foreign policy? What would be the relationship between the NACA, the ARPA, the President's Scientific Adviser, and the Secretary of State?

(3) What agency or official would coordinate our national outer space effort with proposals for international cooperation? Is it contemplated that the National Security Council will function in this area?

(4) What agency will handle questions of international space law?

(5) Is NACA strongly favored by the scientists as an agency offering the best atmosphere for a working relationship between science and government?

5. *Development of outer space within a department of science.*—Proposals have been advanced for a department of science at the Cabinet level, and if this step were taken, outer space would be one of many subjects which would be referred to the new organization. Since this proposal would involve the transfer of scientific activities from practically every department of the Government, its evaluation would necessarily include far more factors than those involved in outer space. An appraisal of how outer-space development might be expected to progress in a department of science would require expert testimony on all of the questions which have been listed in this paper.

B. Alternative proposals for organization of the Congress

Proposals have been made for establishing a new joint committee on outer space and for giving the jurisdiction of outer space to the present Joint Committee on Atomic Energy. It would also be possible to have separate House and Senate committees to deal with this subject, although this idea does not seem to be "in the wind" as a permanent arrangement at the present time.

The question of whether the Congress can have two joint committees working on such closely related subjects as outer space and atomic energy would seem to require the same type of analysis as that suggested in this paper for the two matching executive commissions.

(1) How closely are the subjects of outer space and atomic energy related?

(2) Would it be possible to have 2 commissions send almost identical bills to 2 joint committees on such a subject as launching devices for long-range missiles and satellites?

(3) If there were a conflict of jurisdiction between the two joint committees, who would decide the referral of bills?

(4) If congressional jurisdiction over outer space is given to the Joint Committee on Atomic Energy, should the name of that committee be changed in accordance with its expanded terms of reference?

(5) Whether outer space is referred by the Congress to its present Joint Committee or to a new one, how will the committee work with other congressional committees which have a primary interest in legislation on such subjects as weather control, communications, navigation, education, and national defense?

(6) Could more coordination in the Congress be achieved by having permanent House and Senate standing committees with representative membership similar to that of the present temporary committees?

An International Outer Space Agency for Peaceful Purposes—A Brief Review of Various Proposals and An Analysis of Possibilities

(By Mary Shepard, analyst, International Organization Foreign Affairs Division, Legislative Reference Service, the Library of Congress)

1. Introduction

Both the feasibility and the relative advantages and disadvantages of an international outer-space agency devoted to peaceful purposes might well depend on the proposed scope of the operations of such an agency. Generally speaking its functions could embrace (1) the pooling of all outer space resources; (2) supervision, research, and development falling short of complete pooling; (3) collaboration limited to pooling of information and research; (4) the study and formulation of rules to govern use of outer space.

2. Pooling of all outer space resources

An example of the conception of pooling all outer-space resources is the plan advocated by Ernest K. Lindley, of Newsweek magazine, to the effect that the United States should take the lead in making two interlocking proposals: 1, to demilitarize and internationalize outer space through the UN and give to a UN agency the task of exploration of space; 2, to propose to the Soviet Union the merging of Soviet and United States enterprises and to invite all nations and peoples to contribute to cooperative efforts to explore space. He suggests collaboration with other nations even if the Soviet Union will not cooperate.[1]

Somewhat along the same lines, the Commission To Study the Organization of Peace has proposed that the United States adopt as a long-run policy "the international ownership and operation of all or certain types of spacecraft." [2]

The Department of State, according to newspaper reports, has under consideration a plan, among other alternatives, in accordance with which an international agency would supervise all outer space projects.[3]

These conceptions bear an analogy to the Acheson-Lilienthal, later the Baruch, plan for the international control of atomic energy, which became United States policy during the early postwar years. Under the Baruch proposal an international agency would have owned and operated the mines and plants for producing atomic weapons, licensed activities in states involving the use of nuclear materials, and would have had uninhibited power of inspection of national industrial and other relevant establishments to ensure that no illicit operations were taking place.

Proposed programs such as these imply that an international agency should not only embrace all present activities involved in the peaceful exploration of outer space but should also exercise control in the crucial areas of outer space weapons development and use. Clearly this kind of outer space monopoly would involve vital issues of national defense and national sovereignty. The Commission to Study the Organization of Peace has concluded in relation to its own above-mentioned suggestions:

"Only in connection with a thoroughgoing system of international control over armaments, including international inspection and a police force, would this alternative (international ownership) seem to be politically practical. It should not be considered separately from the crucial question of international inspection which is now under discussion." [4]

Generally speaking materials and instrumentalities used in the exploration of space, and the knowledge gained from such exploration, can be used for war as well as for peace. Not only can they be used for war, they lie at the very heart of evolving national weapons systems. A like duality of application has haunted and hampered the development of atomic energy for peaceful purposes. The Soviet sputniks were launched into outer space with intercontinental ballistic missile (ICBM) rockets and the United States EXPLORER was placed in orbit by the JUPITER C, developed by the Army. Even at this early state it is clear that much of the data which these satellites have transmitted could have military significance.

Despite Department of State study, it is doubtful if the United States Government would go so far as to propose an international outer-space development

[1] Newsweek magazine, January 20 and 27, and February 8, 1958.
[2] Commission To Study the Organization of Peace. Strengthening the United Nations. New York. Harper & Bros., 1957, p. 219.
[3] New York Times, January 19, 1958, p. 1.
[4] Op. cit., p. 218.

monopoly. There is only the remotest possibility that the Soviet Union would consider such a plan, if proposed.

3. Supervision, research, and development falling short of complete pooling

The difficulties of establishing an international monopoly in an area vital to the national defense and to the technological advancement of nations, in a world divided by conflicts of ideology and interest, were made abundantly evident during the negotiations over the Baruch proposal. On the other hand, a number of international organizations testify to the efficacy of an approach which seeks to design an instrument with purposes and functions judged to be within the bounds of practicality.

The examples that come most readily to mind are, on a regional basis, the European Coal and Steel Community and the European Atomic Energy Community. The Coal and Steel Community exercises supervisory control over the activities of its member-nations but it does not engage heavily in operational programs as such. The Atomic Energy Community, on the other hand, goes a long way in the direction of a real pooling of resources. Through it distribution will be made of available surplus uranium resources. Joint enterprises and joint development of research and dissemination of information are listed as being among the functions of the Community. Politically, these agencies are contributing to the soldering of the ancient rifts between France and Germany and to the integration of Europe as a whole.

On an international basis, the most outstanding recent example of a part-way organization of this kind is the International Atomic Energy Agency. In brief, the functions of the Agency are (1) to assist research on, and the practical application of atomic energy for peaceful purposes; (2) to act as an intermediary in supplying materials and services; (3) to foster the exchange of scientific and technical information and to encourage the exchange and training of scientists; (4) and to establish safeguards to insure that its materials, services and facilities are not used for military purposes.

Suggestions have been made that a similar international agency could be established to explore and exploit outer space for peaceful purposes, to the extent that such joint endeavors were found to be practicable. Senate majority leader, Lyndon Johnson, for example, has called for joint exploration of outer space by the United Nations.[5] Former United States disarmament negotiator, Harold Stassen, has advocated a United Nations Space Development Agency" which would endeavor as a United Nations project to send the first man into space and to send the first inspection photographic satellite around the earth."[6] Senator Hubert Humphrey, chairman of the Senate's Disarmament Subcommittee, has proposed that the United States "take the lead in marshaling the talents and resources of the world to unlock the mysteries of outer space in joint research and exploration under the auspices of the United Nations."[7]

In pointing out the desirability of such an agency Representative Robert Hale has stated that it would not be necessary to bar all military experimentation in outer space in seeking to divert energy and resources, on an international basis, to peaceful exploitation. He has commented that:[8]

"Mr. Eisenhower did not maintain the inflexible position in that (atomic energy) proposal that all nations must agree to stop producing atomic energy for war purposes. Rather, he recommended that at least some of this power potential be devoted to peaceful uses beneficial to mankind * * *"

Last March the Soviet Union proposed the establishment of a United Nations agency for international cooperation in the study of cosmic space as part of a four-point disarmament program. The functions of the agency would be to—[9]

1. Work out an agreed international program for launching intercontinental and space rockets with the aim of studying cosmic space, and supervise the implementation of this program.

2. Continue on a permanent basis the research in cosmic space now being carried on within the framework of the International Geophysical Year.

3. Serve as a world center for the collection, mutual exchange and dissemination of information on space research.

4. Coordinate national research programs for the study of cosmic space and render all-round assistance and help toward their realization.

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[5] Congressional Record, February 3, 1958.
[6] Washington Post, March 10, 1958, p. A6.
[7] Speech delivered before Institute of Arms Control for World Security, February 19, 1958.
[8] Congressional Record, January 23, 1958, p. 685.
[9] Washington Post, March 16, 1958, p. 1.

In recent testimony before the Senate Committee on Space and Astronautics Mr. Loftus E. Becker, legal adviser of the Department of State, indicated that the United States favors international machinery for the exploration of outer space for peaceful purposes. He suggested that the principal responsibility of such an agency should be to promote and coordinate outer space activities. Its functions might include, among others, the establishment of international space regulations; the collection and exchange of information; and the coordination and planning of outer space research and exploration. He pointed out that the agency's activities "could be pursued independently of control arrangements over military uses of outer space." He referred to the International Atomic Energy Agency as a suitable precedent and example for such an agency.[10]

The objective of international cooperation might be achieved simply by extending the functions of the International Atomic Energy Agency (IAEA) to cover outer-space activities. If a separate agency were judged to be desirable some conception of its possible activities may be gained by substituting in a listing of the functions of the IAEA, the terms "outer space" for "atomic energy." (See annex attached.)

Other international organizations whose areas of competency could be extended to cover outer-space enterprises engage in various supervisory, regulatory, research, and operational activities. The United Nations Educational, Scientific and Cultural Organization is empowered to promote "collaboration * * * through science" among nations. The International Civil Aviation Organization is authorized to "promote generally the development of all aspects of international civil aeronautics." Examples of its operational programs are aid in the development of ground services required by civil aviation, in commercial pilot training and in instruction in the maintenance of aircraft.

Expert scientists assert that adequately instrumented satellites may in the future provide information leading to enormous progress in weather forecasting, and that it may even be possible sometime to control weather from outer space. An international organization which deals with weather phenomena is already in existence. The World Meteorological Organization (WMO), which was founded "with a view to coordinating, standardizing, and improving world meteorological information between countries * * *," supports the development of activities of international meteorological importance.

It is also anticipated that, through the use of outer-space vehicles, it will be possible in the future greatly to expand the range of broadcasting. Moreover, international communications could become vastly more effective if, as seems probable, signals emanating from some future properly equipped satellite will be impossible to jam. An international organization, the International Telecommunications Union, is already promoting the development and efficient operation of technical telecommunication facilities. Its operational program includes responding to requests from governments of underdeveloped countries for technical experts and the sponsorship and organization of fellowship programs on technical telecommunication problems. The Soviet Union is a member of all of these organizations except the ICAO.

International collaboration for the exploration and exploitation of outer space might well be conducted through one or a combination of the above-mentioned agencies. The International Atomic Energy Agency would seem to be peculiarly adapted to an expansion of its functions to embrace such collaboration, in view of the fact that it engages to a greater extent in operational activities than some of the others and includes important safeguards against the diversion of its resources to military purposes. In view of the uses to which outer-space instrumentalities could be put, this last consideration would seem to be of some importance.

4. Collaboration limited to pooling of information and research

An agency limited to this kind of function would not engaged in operational activities but would simply act as a clearinghouse for information and as a center for research or for the supervision or coordination of research. The international organizations already referred to—UNESCO, ICAO, WMO, and ITU, as well as the International Atomic Energy Agency—devote a major part of their effort to the gathering and dissemination of information and to the study of major problems arising in their particular fields.

For example, the ICAO has held regional air-navigation meetings to examine existing facilities for airports, navigational aids, communications, air-traffic con-

[10] Statement of Loftus E. Becker, legal adviser, Department of State, Special Senate Committee on Space and Astronautics, May 14, 1958.

trol, meteorology, and search and rescue and to determine what additional facilities and operating procedures were needed to make flying in the various regions more satisfactory. Other subjects studied by ICAO include transport costs and rates for international air mail and the problem of multiple, discriminatory, and unfairly burdensome taxation. It continually collects, analyzes, and publishes statistical information relating to international aviation services. The other agencies engage in corresponding activities in their own fields.

Another example of an international organization established primarily for research and the dissemination of information, this one under nongovernmental auspices, is the one under which the present international satellite program is being carried out, the Special Committee for the International Geophysical Year. The organization of the International Geophysical Year is in most of its aspects highly decentralized. The participating national groups in each country have been left free to run their own programs. Overall coordination, organization, and collection and dissemination of information are being carried forward under the auspices of the International Council of Scientific Unions through the special committee. Only in the United States and in the Soviet Union have facilities been made available, under Government auspices, for the launching of artificial satellites, but a number of other nations have joined in tracing the orbits of the satellites and in recording the signals emitted from them. All participants in IGY agreed beforehand that there should be a full exchange of all data and three world data centers have been established to facilitate exchange.

Of particular note also is the International Astronautical Federation, a nongovernmental organization which engages in various activities designed to stimulate upper atmosphere research and exchange of information.

There have been a number of unofficial suggestions in the United States, as well as the official Soviet proposal, to the effect that the International Geophysical Year should be extended for a number of years or indefinitely, suggestions which if implemented would provide a means for a joint research and the pooling of information in a wide field of scientific endeavors, including outer-space exploration. A similar suggestion, although one not applied specifically to outer-space problems, has come from President Eisenhower who, in his 1958 state of the Union message, proposed a "full-scale cooperative program of science for peace." He explained that—

"A program of science for peace might provide a means of funneling into one place the results of research from scientists everywhere and from there making it available to all parts of the world * * *."

Senator Alexander Wiley has called upon the scientists themselves to take the lead, as they have in the International Geophysical Year:[11]

"I suggest that scientists of our Nation, working through national scientific organizations, investigate the possibility of forming an international scientific organization on outer-space problems. This group of scientists would represent the best brain power of all nations of the earth to plan for coordinated and dynamic programs of peaceful utilization of outer space * * *."

It should be noted, however, that it would be difficult for private scientific organizations to dispose of the means, physical or financial, for an exploration of the upper atmosphere. As has already been pointed out, the IGY satellite program, although conducted under nongovernmental auspices, has relied heavily upon the United States and Soviet Governments for facilities to carry out its major experiments.

5. The study and formulation of rules to govern the use of outer space

There is another approach to the problem of exploring space for peaceful purposes, and that is to seek some way of laying down rules which would have the effect of prohibiting military uses of outer space and of regulating peaceful uses. From a general point of view, the most important aspect of such rulemaking would have to do with limiting use to peaceful purposes. However, rules of this kind would be of little value with an inspection and control system to guarantee that they would be carried out by all. Although the United States and other nations have proposed the adoption of such rules and the establishment of a committee to study inspection and control, the Soviet Union has maintained that the subject can only be considered in relation to the elimination of what it terms "foreign military bases."

Sir Leslie Munro, present President of the U. N. General Assembly, has advanced the idea that the United Nations is the "proper * * * and only appro-

[11] Congressional Record, February 26, 1958, p. 2443.

priate body to establish a code of law and practice to deal with transit through outer space jurisdiction over such parts of it as men may reach." He suggests calling a diplomatic conference to draft appropriate conventions, explaining: [12]

"While I favor the examination of the whole subject eventually in the U. N. Assembly, where all states, great and small, can be heard, I suggest that before the Assembly takes up the problem, a diplomatic conference similar to that on the law of the sea be held soon in Geneva. In such an expert gathering, diplomats and lawyers can take into account not only the legal but also the technical, economic, and political aspects of the problem and embody the results of their work in one or more international conventions or similar instruments."

There is no reason why the functions of the international organization already mentioned could not be extended to cover such rulemaking on peace-directed outer-space activities as may become necessary in the future. One of the most important functions of the International Civil Aviation Organization, for example, is to insure the highest practicable degree of uniformity in international civil aviation regulations. Toward this end the ICAO has adopted 15 sets of standards and recommended practices, which are constantly being revised. All 15 of these are in effect in all territories of ICAO's member states. Some of these standards, such as the following, could be revised to include outer-space activities:

(1) Meteorological codes—which specify the various systems used for the transmission of meteorological information;

(2) Aircraft nationality and registration marks;

(3) Aeornautical telecommunications—dealing with the standardization of communications systems and radio air navigation aids;

(4) Aeronautical information services—dealing with the uniformity in methods of collection and dissemination of aeronautical information.

In addition, ICAO has been instrumental in the drafting of various international air law conventions. It should be possible to extend the scope of ICAO's activities to cover the drafting of conventions regulating the use of outer space for peaceful purposes, at least in certain areas, if and when such conventions should become necessary.

Although the Soviet Union is not a member of the ICAO it has in the past tacitly conformed to international civil aviation practice. However, only if the Soviet Union actually became a member might it be advantageous to extend ICAO's functions to cover outer-space matters.

Similarly, one of the basic functions of the International Telecommunication Organization is to secure agreement among its members on operating practices, standards, and regulations to facilitate international communications by radio, as well as other mediums. Presumably its terms of reference already include any uses to which outer space vehicles may be put in the future for the improvement of telecommunications. The same thing could be said of the World Meteorological Organization. The WMO has established technical commissions which standardize methods, procedures and techniques in the application of meteorology and recommend technical regulations. There are technical commissions for aerology, aeronautical meteorology, agricultural meteorology, bibliography and publications, climatology, instruments and methods of observations, maritime meteorology, and synoptic meteorology.

6. Concluding comments

There have been numerous private proposals in the United States for the joint exploration of outer space for peaceful purposes, and semiofficial suggestions from both the United States and the Soviet Governments.

At best, the role of international organization would be that of coordinating a program of space research and development in which the United States, the Soviet Union and perhaps Great Britain were the major contributors. However, certain distinct advantages could accrue from such an initiative. The exploitation of outer space will require tremendous effort, both in terms of funds and of scientific brainpower, an effort which even the major powers may find hard to make alone. Through international organization a way could be opened for the employment of talents from anywhere, or at least the free world, in the tremendous creative undertakings which lie in the "leap into space."

It can also be argued that when nations strive together on enterprises of great magnitude and international significance, the results can be both generally

[12] Munro, Leslie. Law for the Heaven's Pathless Way, New York Times Magazine, February 16, 1958, p. 80.

useful and in variable extents unifying. This has been demonstrated recently in the organization of the International Geophysical Year where 67 states, including the Communists, have coordinated their resources and efforts to increase mankind's knowledge of his universe. Numerous other international organizations provide similar examples.

More tenuous and less specific are the hopes—and they are only hopes—that a small beginning of collaboration between the Soviet and the West on outer space might, as the New Republic put it: [18]

"* * * just might—lay the groundwork for later international projects of space exploration and perhaps even help to keep the bugaboo of space 'control' under control."

On the other hand it is doubtful if as much international enthusiasm could be generated for the joint exploration of space as has always been evident with relation to the development of atomic energy for peaceful purposes. Peoples everywhere, particularly in the underdeveloped areas, see in the atom an enormous potential source of energy and of technological progress, a means by which their standards of living may be raised or maintained at a high level. The benefits which exploitation of space may bring to the "common man," on the contrary, are considered at the present time remote and uncertain.

ANNEX

Proposed Functions of an Outer Space Agency

(Adapted from the Statute of the International Atomic Energy Agency)

A. The Outer Space Agency is authorized—

1. To encourage and assist research on, and development and practical application of, the exploration and exploitation of outer space for peaceful uses throughout the world; and, if requested to do so, to act as an intermediary for the purposes of securing the performance of services or the supplying of materials, equipment, or facilities by one member of the Agency for another; and to perform any operation or service useful in research on, or development or practical application of, the conquest of outer space for peaceful purposes;

2. To make provision, in accordance with this Statute, for materials services, equipment, and facilities to meet the needs of research on, and development and practical application of the uses of outer space for peaceful purposes. * * *

3. To foster the exchange of scientific and technical information on peaceful uses of outer space;

4. To encourage the exchange and training of scientists and experts in the field of the peaceful uses of outer space;

5. To establish and administer safeguards designed to ensure that materials, services, equipment, facilities, and information made available by the Agency or at its request or under its supervision or control are not used in such a way as to further any military purpose; and to apply safeguards, at the request of the parties, to any bilateral or multilateral arrangement, or at the request of a State, to any of that State's activities in the field of the exploration and exploitation of outer space;

6. To establish or adopt, in consultation, and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for the minimization of danger to life and property, and to provide for the application of these standards to its own operations making use of materials, services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision; and to provide for the application of these standards, at the request of the parties, to operations under any bilateral or multilateral arrangement, or, at the request of a State, to any of that State's activities in the field of the conquest of outer space;

7. To acquire or establish any facilities, plant and equipment useful in carrying out its authorized functions, whenever the facilities, plant, and equipment otherwise available to it in the area concerned are inadequate or available only on terms it deems unsatisfactory.

[18] Ah, Space. The New Republic, February 3, 1958, p. 5.

B. In carrying out its functions, the Agency shall—

1. Conduct its activities in accordance with the principles of the United Nations to promote peace and international cooperation, and in conformity with the policies of the United Nations furthering the establishment of safeguarded worldwide disarmament and in conformity with any international agreements entered into pursuant to such policies:

2. Establish control over the use of special materials received by the Agency, in order to ensure that these materials are used only for peaceful purposes;

3. Allocate its resources in such a manner as to secure efficient utilization and the greatest possible general benefit in all areas of the world;

4. Submit reports on its activities annually to the General Assembly of the United Nations and, when appropriate, to the Security Council; if in connection with the activities of the Agency there should arise questions that are within the competence of the Security Council, the Agency shall notify the Security Council, as the organ bearing the main responsibility for the maintenance of international peace and security, and may also take the measures open to it under this Statute * * *

5. Submit reports to the Economic and Social Council and other organs of the United Nations on matters within the competence of these organs.

C. In carrying out its functions, the Agency shall not make assistance to members subject to any political, economic, military, or other conditions incompatible with the provisions of this Statute.

D. Subject to the provisions of this Statute and to the terms of agreements concluded between a State or a group of States and the Agency which shall be in accordance with the provisions of the Statute, the activities of the Agency shall be carried out with due observance of the sovereign rights of States.

SPECIAL REPORT PREPARED BY AIR INFORMATION DIVISION OF THE LIBRARY OF CONGRESS FOR THE SENATE COMMITTEE ON OUTER SPACE

THE SOVIET SPACE EFFORT

ORGANIZATION, EQUIPMENT, OBJECTIVES, AND PERSONNEL

SECTION 1—INTRODUCTION

The Soviet Union announced its decision to launch an artificial satellite at the International Congress of Astronautics in Copenhagen in August 1955 (R. 17).

The Soviets regard the launching of a satellite as the next step in the development of rocketry and the first step to the solution of interplanetary travel. Soviet official interest in space travel dates back more than a quarter of a century when GIRD's (Groups for the Study of Reactive Propulsion) were organized in Moskva, Leningrad, and other cities. Since World War II this interest has intensified. An Astronautics Section has been created at the Central Aeroclub (imeni Chkalova) in Moskva and a special Inter-Agency Commission has been set up at the Academy of Sciences for the purpose of coordinating Soviet space effort (R. 8, 9, 25).*

The current sputniks are the result of many years of work on the part of Soviet engineers and scientists. They have been conceived as an integral part of the IGY program to study the structure of the ionosphere and of the atmosphere. Special attention is to be paid to radiation studies of cosmic rays and solar radiation in the ultraviolet and X-ray ranges. Satellites will also be used for study of fluctuations of the magnetic field of the earth and of the effect of meteors and micrometeors on space vehicles. It is anticipated that satellites will provide interesting information on the effect of weightlessness on animal life (R. 6, 7, 9, 30, 42).

Some of the above phenomena have already been measured by means of high altitude rockets but for very short periods of duration. The obvious advantage of the sputniks is that they permit observations over prolonged periods of time and over large areas of the earth's surface. Other applications of artificial satellites also present themselves. Sputniks could be used for experimental checking on the theory of relativity (by observation of the displacement of the perigee), measurement of gravitational displacement of transmitter frequency

*Indicates references at end of report.

of the sputnik, and measurement of intensity of luminescence of the metagalaxy from the sputnik (R. 9, 39).

The primary problem of putting an artificial satellite into orbit involves construction of rockets capable of performing the task and calculation of proper orbits. But a whole group of secondary problems arise which complicate the task if the satellites are to be manned. These problems are largely biological in nature such as overcoming the effects of acceleration of more than 2G's, the effects of weightlessness of protracted periods of time, the effects of radiation, lack of normal pressures, etc. (R. 4, 15, 24, 43).

Some of these problems can be studied under laboratory conditions more easily than others. Soviet scientists have made extensive studies of certain aspects and have devised air-tight cabins, pressure suits, and space suits. Considerable effort has gone into design of instruments which can operate independently for long periods. These automatic recording instruments present difficulties in design since on the one hand they must be light, compact, and operate on small amounts of power and, on the other, they must be sturdy enough to stand the effects of stress, vibration, and considerable variations in temperature and pressure (R. 4, 43).

Still another problem is that of rocket fuels and in this field much research remains to be done. The current Soviet rockets operate on more or less conventional liquid fuel systems but research is moving in the direction of exotic fuels. One Soviet source claims that satisfactory results have been obtained with chemical fuels recently by the use of metallic additives such as aluminum and magnesium. Currently work is being done on hydrogen compounds of boron and lithium. Interesting results have been obtained with boron ethyl, boron alkyl, and pentaboron. Experiments with pentaboron have proved to be particularly rewarding and specialists predict a bright future for this type of fuel (R. 5, 15, 24).

SECTION 2—SOVIET ROCKET PROGRAM

The launching of high altitude rockets has been practiced in the U. S. S. R. for a long time. These rockets have been used for investigation of the upper layers of the atmosphere and the ionosphere. Instruments carried aloft have been used to measure temperature and pressure of the atmosphere up to elevations of 200 km. Rockets have also been used to measure the magnetic field of the earth from elevations of more than 100 km. Radiation studies are also made and rockets have been used to study primary cosmic radiation and corpuscular radiation of the sun. Studies have been made of the velocities at which they enter the atmosphere and the effect of various types of radiation on living organisms. The velocities of meteors and micrometeors encountered in the upper layers have also been studied for the purpose of determining the "meteoric hazard" (R. 3, 7, 8, 37, 39, 42).

With the onset of the IGY the Soviet rocket program has been intensified. In July and Aug. 1957 two series of high altitude rockets have been launched from the "middle latitudes of European U. S. S. R." During the entire 18 months of the IGY the U. S. S. R. expects to launch no less than 125 high altitude rockets; 70 from "middle latitudes of European U. S. S. R.," 25 from the Bukhta Tikhaya observatory on Franz Joseph Land, and 30 from the Mirnyy observatory in Antarctica (R. 9, 27, 33, 40, 48).

In addition to the heavy rockets, referred to above, the U. S. S. R. has several types of lightweight rockets for meteorological purposes. These rockets are capable of bearing aloft a limited number of meteorological instruments up to an altitude of several dozen km. The use of these rockets for aerological work is almost routine (R. 9).

SECTION 3—HIGH ALTITUDE RESEARCH ROCKETS

Rockets for probing the upper layers of the atmosphere are launched from special reinforced concrete ramps with guiding rails. The servicing and scientific personnel are protected by concrete, underground bunkers during the launching (R. 8).

American and British scientists have, in general been installing recording instruments in the noses of rockets. In order to avoid "contamination" of measurements by rocket gases, U. S. S. R. scientists rely on special research rockets with detachable instrument containers. These rockets were designed by the Institute of Applied Geophysics. * * * The two instrument containers fit within two "mortar" tubes attached laterally to the opposite sides of a rocket.

The front openings of the "mortar" tubes are then covered by streamlined caps (R. 8, 9, 26, 27, 33).

At an assigned altitude (i. e., several dozen km. after the rocket engine quits and the rocket is coasting on its momentum) the containers are shot out of the "mortar" tubes by special charges. After receiving this extra boost the containers forge ahead and slightly to the side of the carrier rocket, moving through air uncontaminated by the rocket. Some time after the containers separate from the rocket, at a preset altitude, a valve opens and lets air into sample bottles in the container. In order to insure identity with the ambient atmosphere, the sample is taken only after the speed of the detached container has dropped to 50–70 m/sec. After that the container continues in free fall until an altitude of 10–12 km., at which time the parachute is ejected. If all goes well, the container then parachutes safely to the ground and lands in an upright position on special rods. The function of the rods is to absorb part of the shock and to keep the container in a vertical position, thereby making it easier to find (R. 8, 9, 33).

The instrument containers are metallic cylinders 2 meters long and 40 cm. in diameter. They consist of three sections (or two if the parachute compartment is not counted). The lower part consists of an airtight compartment housing instruments, power supply, programming mechanism, etc. The middle section consists of open grillwork and contains air sample bottles. To limit desorption, only metal glass, ceramic, and negligible amount of vacuum rubber (in the form of thin padding between metal and glass of the bottles) is used in the open compartment. The upper section, which is also sealed, contains the parachute (R. 3, 8, 9, 26, 33).

Non-Soviet practice is to use metal air bottles, since only inert gases are being analysed, and glass is a poor container for helium. In addition, the recovery of glass bottles is particularly difficult. Nevertheless, Soviet investigators use glass bottles 400 to 5,000 cc. in capacity, equipped with special valves. The glass bottles are prepared by washing in alcohol and evacuating down to pressures of 10^{-6} mm. Hg. with a simultaneous heat to 300°–400° C. Since a bottle thus prepared may wait in storage for some time, it is again evacuated one or two days before launching. This second evacuation provides an opportunity for checking the vacuum in the bottle and if the pressure rose to 10^{-4} mm. Hg. or more, the bottle is rejected as defective (R. 8, 26).

The greatest difficulty encountered in setting up this equipment was design of the valve. In American practice metal bottles with metal tubes are used. The tubes are opened with special knives and closed by flattening them out in order to provide an airtight seal. In selecting valves a Soviet scientist considered various possibilities. Valves involving fusing proved unsuitable because of liberation of "parasitic gases". Finally a usual type of vacuum stopper with an opening of about 1 cm^2 was selected. This ground glass stopper had better than normal quality of surface finish. Ceresin (a mixture of high polymer hydrocarbons, Cn H_{2n+2} was used as a lubricant. Ceresin is sufficiently inert chemically with regard to gases under consideration and has valuable mechanical properties. It permits free rotation of stopper when hot and provides a perfect seal when it cools off to a solid (R. 26).

The valve itself has two spiral springs which provide a couple tending to rotate the stopper. Motion of the stopper is prevented by friction of the cold solid ceresin. A heating wire wound around the stopper melts the wax at a predetermined time. This permits the stopper to make a quarter turn which opens the bottle. Further movement is arrested by a low melting point wire which is part of the electric circuit. After 10 seconds (a sufficient time to equalize the ambient and bottle pressures) the current melts the wire permitting the stopper to make another quarter turn which closes the valve. The ceresin solidifies again providing a vacuum seal for the bottle (R. 26).

The gas samples taken from high altitudes were subjected to a quantitative spectrum analysis developed in the U. S. S. R. by S. E. Frish. The sample air from the sample bottle is forced into a very thin tube by filling the bottle with mercury. A high frequency voltage is applied to the terminals of the tube causing the gases within to glow. Spectrum of this glow is photographed and compared to sample spectrographs of known gas mixtures. This method has been refined to the point where it can be applied to samples not greater than hundredths of one cc (which corresponds to altitudes of 130–140 km.). This quality of a given gas in the sample has an error of about 5–6%. In Soviet practice the time interval between taking of the sample and its analysis amounts to an average of 2–5 days. In American practice this interval has varied from 6 weeks to as much as 18 months (R. 8, 26).

The above method is applicable only up to altitudes of 150 km. Thereafter the atmosphere is so rare that only bottles of excessive size could provide sufficient quantities of air for analysis. The problem is solved by the use of radio frequency mass-spectrometer which is installed directly into the instrument container. Although this instrument is less sensitive than the magnetic type of mass-spectrometer used in laboratories it is much ligher and less bulky. It determines the composition of air continuously through a wide range of altitudes and its indications can be photographed or transmitted by radio (R. 8, 9, 26).

The method of using detachable instrument containers appears to have advantage for measurement of other parameters as well. For example, while direct measurements of air pressures at altitudes from 50 to 80 km. performed by instruments in detached containers closely compare to figures obtained by American scientists, whose instruments were located within the rocket itself, however when altitudes of 80 to 100 km. were reached, pressures obtained by Soviet scientists were smaller than those obtained by U. S. scientists. At present, American investigators have introduced a correction factor to compensate for air and gases escaping from the rocket and the corrected figures are quite close to Soviet figures (R. 9).

Thermal gauges, magnetic electric-discharge gauges, and ionization manometers are used for determination of pressures at various altitudes (R. 9, 27).

The rockets are also equipped with instruments for measuring ultra-violet and X-ray spectra of the sun and cosmic radiation. Cameras are used for recording the readings. Photographs of the earths surface have been made from elevations of several hundred km. (R. 8, 9).

SECTION 4—ANIMALS IN ROCKET RESEARCH

Because of their interest in the conquest of space Soviet scientists have been experimenting with animals and microorganisms for a number of years. Contrary to the American practice of using anesthetized animals (monkeys and mice) the Soviets concentrated on the use of animals which are fully awake. Because of the ease with which they could be trained. Soviets selected dogs. They succeeded in sending dogs into the upper layers of the atmosphere as far back as 1951. (R. 4, 8, 33).

In order to find out conditions detrimental to man in space, a number of experiments were performed with animals under laboratory conditions. First of all, dogs were placed in a pressure chamber and the pressure was dropped from the normal down to 30 mm. of mercury for 2/100 or 3/100 of a second. Thirty seconds later dogs developed subcutaneous swellings. Then acceleration experiments were performed on human beings. Men stood accelerations of 3 to 4 G's without difficulty. At 5 or 6 G's they complained of pains in their chests. At 7G's they could breath only with difficulty and no one could withstand accelerations of 8 G's for more than 2 minutes (R. 33, 46).

Since even the strongest artificial radioactivity sources cannot match the energy of cosmic radiation in space it is obviously impossible to test animals under laboratory conditions. Consequently, grey mice were taken aloft in balloons and kept there for a 24-hour period. At first these animals appeared to experience no ill effects but 2 years later their fur turned "silver" along the spine, a typical symptom of radiation sickness. Worms were also taken aloft and their progeny began to degenerate. The seventh generation of inbred worms died before reaching maturity (R. 33, 43, 46).

Before dogs could be used for high altitude research they had to be conditioned. They were held in pressure cells, taken up in aircraft, and kept in grounded rockets. At the end of each two-hour period spent in a sealed cabin they would be given tidbits as rewards. Dogs who were irritable or impatient were eliminated. This training went on for 2 months, until the dogs were completely adjusted to the sealed cabin and to the senders (i. e., meters) which were inserted into the dogs for the purpose of measuring heart beat, breathing, skin temperatures, etc. (R. 8, 33).

During the first series of experiments dogs were placed into an airtight cabin in the nose of the rocket. Dogs were strapped in place by special harnesses and a supply of oxygen was maintained by means of regenerative system. After reaching an elevation of 110 km. the cabin with the dogs was detached from the rocket. Then free fall of the cabin began. Tremendous velocities were attained in the thin upper air. Then the denser air slowed the cabin down and at about 3 km. elevation the parachute opened and the cabin landed safely on specially provided shock absorbers (R. 4, 8, 33, 43).

These experiments did not produce any apparent changes in the organism of the animals. Although the animals were subjected to surges of more than 5 G's and prolonged weightlessness during the free fall they appeared to be in good condition after landing (R. 3, 4, 8, 43).

During the second series of experiments, dogs were sent aloft in individual space suits made of rubberized cloth with transparent plexiglas helmets. Each dog had 3 bottles of oxygen (about 900 liters) which was enough for a two-hour period. The programing mechanism, parachute, and oxygen supply, together with the dog in its suit were placed on special "catapult carts." In this assembled state each cart weighed about 70 kg. (R. 8, 33).

At an altitude of 110 km. the rocket nose separated from the body and began a free fall. The nose was then allowed to fall some 20 or 30 km. until it attained velocities of about 2,500 km. per hour. At this point (some 89–90 km. elevation) the first "catapult cart" was shot out by means of an explosive charge which gave the cart a velocity of 700 m/sec. and subjected the dog to 6 G's. The whole process took about 0.2 sec. After 3 seconds the parachute opened and the dogs begin a parachute descent which takes about an hour from an altitude of 75–85 km. (R. 2, 8, 33).

The second "cart" was ejected by a similar charge at an elevation of 35–40 km. when the nose of the rocket was falling with a velocity of 1,000–1,150 m/sec. In this case the parachute was timed to open at an altitude of only 3–4 km. (R. 3, 8, 33).

Instruments for automatic recording of reactions of the animals in flight, free fall and parachute descent were placed on the "catapult carts." The instruments recorded the breathing rate, pulse, body temperature, and the maximum and minimum blood pressure. A pressure of 440 mm. of Hg. was maintained within the space suits in flight (R. 8).

Sometimes a parachute would be carried more than a hundred km. away from the launching site and would require several days to find. To prevent dogs from suffocating, the space suits were equipped with special valves which opened automatically at altitudes below 4 km. Of the twelve dogs used in this series none died from shortage of oxygen, meteorites, cosmic rays, or other factors encountered in the upper air. Still one of the dogs died during its second flight due to a defect in one of the rockets which exploded. Photo films in an armored film holder survived the explosion (R. 8, 33).

Automatic filming process in the rocket prior to catapulting of the "carts" had to be carried out with the aid of a system of mirrors since the limited space in the cabin did not permit the placement of the camera directly in front of the animals (R. 8).

The successful results of operation of the safety system under such varied conditions prove the effectiveness of the space suits, ejection devices, parachuting system, automatic controls, etc. After the above flights were carried out five or six years ago (i. e. 1951–52), other series of tests have been made in which the animals were carried twice as high (i. e. to elevations of 200 to 210 km.) in airtight cabins. Again the equipment and dogs withstood the flights well, showing that we were now ready to begin experimental flight in space (R. 43).

SECTION 5—SPUTNIK I, LAUNCHING AND ORBIT

The first Soviet Sputnik was launched on October 4, 1957. It was launched by a specially developed high altitude rocket with a highly effective automatic control system designed to hold the rocket in the required trajectory. The launching rocket started vertically and after a very short time the programing mechanism began a gradual deflection of the rocket axis from the vertical. At the end of the launching trajectory section, the rocket was placed in orbit at a velocity of about 8,000 m/sec. The average elevation of the orbit was about 900 km. After the rocket was in orbit, the nose cone was ejected, the satellite left the rocket and began to move independently (R. 2, 10, 15, 44).

The orbit of the satellite was a rounded ellipse with a maximum elevation of about 1,000 km. It required about 1 hour 35 minutes for it to complete one revolution around the earth. Due to the fact that the orbit deviates about 65° from the plane of the equator means that the rotation of the earth displaces its path by about 24° longitude. The perigee of the orbit is in the Northern and the apogee in the Southern hemisphere. The period of revolution of Sputnik I was decreasing at the rate of about 3 sec. per 24-hour period. This rate of shortening enabled scientists to calculate its probable life span (R. 2, 10, 15, 21, 44).

SECTION 6—SPUTNIK I, CONSTRUCTION AND INSTRUMENTATION

The first sputnik is spherical in form. It has a diameter of 58 cm. and a weight of 83.6 kg. Its airtight body is made of aluminum alloys. Its surface is highly polished and specially treated. A large portion of its volume is taken up by the power supply. Its high weight-to-volume ratio implies successful design of internal equipment. Before launching, the satellite is filled with gaseous nitrogen. The externally protruding antennas consist of four rods 2.4 to 2.9 meters long. During the launching flight the antenna rods are pressed to the shell of the rocket. After separation the antennas spring into position on their hinges. The nitrogen gas in the satellite is under forced circulation to help maintain an equitable temperature in the interior of the satellite (R. 2, 9, 15, 45).

The satellite is equipped with instruments for measuring the following parameters: atmospheric temperature, pressure, and density; intensity and velocities of primary cosmic radiation, solar X-rays, solar ultraviolet rays; meteors and meteoric dust; degree of ionization and composition of electrically charged particles; and finally, static charges on the surface of the sputnik and loss of nitrogen from the inside of the sphere (R. 1, 2, 6, 7, 9, 23).

According to V. G. Fesenkov, Sputnik I also had photographic equipment. However its purpose was to record instrument readings rather than photograph the surface of the earth (R. 21).

Air pressures were measured by means of ionization manometers which performed so well in high altitude rockets. The intake ports are designed in a way to reduce and correct errors arising from aerodynamic reasons. The composition of air was determined by means of a frequency mass-spectrometer. A dynamic charge meter was used for determination of electric charges on the surface of the satellite. There was also a proposal for setting up instruments in Sputnik I for measurement of the magnetic field of the earth. However it is not clear as to whether it was done (R. 9, 42).

SECTION 7—SPUTNIK II, ORBIT AND STRUCTURE

The second Soviet satellite (Sputnik II) was launched on November 3, 1957. It was placed in orbit by means of a super long-range, multi-stage, ballistic intercontinental rocket. The rocket rose to an elevation of several hundred km. and released Sputnik II with a velocity of about 8,000 m/sec. Its velocity in orbit was determined by means of the Doppler effect. This method can determine velocity with an accuracy of 0.01% according to Prof. S. Khaykin. The orbit is elliptical, with the apogee in the northern hemisphere at an elevation of about 1,700 km. and the perigee in the southern hemisphere at an elevation of about 1,000 km. Its period of revolution around the earth is 103.7 minutes. It performs about 14 revolutions per diem. Sputnik II also rotates or tumbles (end over end) around its own axis. The tumbling motion takes about 20 seconds to complete the cycle (R. 1, 18, 19, 20).

Unlike the first satellite, Sputnik II is simply the last stage of the carrier rocket on which instruments are installed. After the nose cone dropped off, the forepart of Sputnik II was revealed as a frame holding an airtight dog cabin and an instrument sphere. The sphere is identical in shape and size to Sputnik I. It houses power sources, instruments, and a programing mechanism. The cabin and spherical container were both made of aluminum alloys and their surfaces were highly polished. The total weight of the frame, containers, instruments, and experimental animal was 508.3 kg. (R. 1, 20).

SECTION 8—SPUTNIK II, INSTRUMENTATION

Sputnik II was designed to supply information on general structure of the ionosphere and to provide data useful for survival in space. The latter was performed by means of an experimental animal. More specifically the second Soviet satellite provided measurement of: primary cosmic rays; solar radiation; atmospheric temperature, density, and pressure; composition of electrically charged particles in ionosphere; meteors and micrometeors; and conditions of radio-wave propagation. It is hoped that these measurements will throw some light on the cause of polar lights, magnetic storms, and other phenomena of the upper atmosphere (R. 1, 7, 10, 23, 39).

Instruments for measurement of solar ultraviolet rays and X-rays were set up on the frame in the nose of the rocket. Instruments for the measurement of cosmic rays were set up on the body of the rocket. Temperature senders were

set up on the external and internal surfaces of the cabin, the instrument container, and individual components (R. 20).

For measurement of the ultraviolet and X-ray radiation Sputnik II is equipped with 3 photoelectric multipliers placed at angles of 120° to each other. Each photomultiplier is equipped with several filters (metallic, organic, and optical) which makes it possible to isolate special ranges of the X-ray spectrum of the sun and the hydrogen line in the high frequency ultraviolet range. Signals from the multipliers are then amplified by radio circuits and transmitted to earth. The significance of using the satellite for this type of measurement is that most of solar ultraviolet and X-rays are absorbed by the atmosphere and cannot be measured from the surface (R. 20).

Since cosmic rays are deflected by the magnetic field of the earth, the degree of penetration varies with the latitude producing the so-called "latitude effect." The satellite, by virtue of passing rapidly from one latitude to another makes an ideal "station" for observing the "latitude effect." Sputnik II measures not only the amount of total cosmic radiation but also the amounts for each of the major types of energy level. In short, Sputnik II studies changes in energy level composition of cosmic rays at various latitudes (R. 20).

Cosmic radiation is studied by Sputnik II by means of two charged particle counters set at right angles to each other. Pulses from the counters are transmitted to special transitor circuits which record the number of pulses until a certain number is reached, after which a special signal is transmitted to earth. Then the registration of numbers is begun over again and again transmitted when the set number is reached (R. 20).

Instruments were set to function for only 1 week after which the power sources on Sputnik II were used up (R. 20).

SECTION 9—THE PASSENGER IN SPUTNIK II

The airtight cabin for the dog is cylindrical in form. It is made of aluminum alloys and its surface is highly polished. The dog had a supply of food, and equipment for regeneration of air and regulation of temperature. Attached to the dog were instruments for measurement of its pulse beat, breathing rate, arterial blood pressure, and biopotentials of its heart. Other instruments recorded temperature and pressure in the cabin. Air within the cabin was purified by a special chemical air-conditioning system which removed excess humidity and carbon dioxide from spent air and added oxygen to it. Since convection could not take place in a state of weightlessness, the cabin had a system for forced circulation of air. This also served to maintain a uniformity of temperature within the cabin. The dog was provided with automatic equipment for rationing of food and water and for removing body wastes (R. 20, 46).

As in the experiments made with dogs in high-altitude rockets so Laika, which was sent up in Sputnik II, was conditioned over a period of weeks to spend long hours in small airtight cabins with instruments of various types attached to its body. Tests were also made of the dog's ability to withstand vibrations and other unusual conditions. The dog was also subjected to accelerations of several G's. In this respect Soviet scientists feel that solutions lie in proper positioning of the body with regard to direction of acceleration and in the use of special pressure suits to prevent accumulation of blood in the extremities (R. 20, 46).

Although Laika was sent up without a pressure suit, results show that the animal was able to withstand the accelerations and vibrations of rocket flight and a state of weightlessness for 4 days without adverse effects. What is not known is whether the walls of Sputnik II were adequate to protect the dog from cosmic radiation. The answer to this last question can only be obtained by a series of satellites with animals and numerous instruments. Such a series is planned, but conclusive results will be possible only after the reentry problem is solved and the animals are brought safely back to earth for laboratory investigation (R. 20, 46).

SECTION 10—TRANSMISSION OF INFORMATION BY SPUTNIKS

Each of the two Soviet satellites was equipped with two 1-watt short-wave radio transmitters. To simplify observations for radio hams, the instruments on the two sputniks were identical and transmitted on frequencies of 20.005 and 40.002 megacycles. The power was sufficient for signals to be received at distances of up to 10,000 km. The external antennas consisted of 4 rods. In

Sputnik I these antennas varied in length from 2.4 to 2.9 meters (R. 2, 11, 15, 20, 21, 44).

Sputnik I had batteries which lasted 24 days. Sputnik II had power sources which lasted only 7 days. In Sputnik I, signals from the two frequencies alternated. The average duration of the signals, on each frequency, lasted on the average about 0.3 seconds. In Sputnik II, signals from the 20.005-megacycle transmitter transmitted at 0.3 sec. intervals but the 40.002-megacycle transmitter was in constant operation. In actual practice the signals lasted from 0.05 to 0.7 sec. in duration and the intervals between signals varied in order to transmit coded information. The code was based on the theory of information, a branch of cybernetics (R. 11, 15, 20, 38, 45).

This code transmits information on pressure, density, chemical structure of the ionosphere, magnetic field of the earth, primary cosmic rays, corpuscular radiation of the sun, ultraviolet and X-ray sections of the solar spectrum, electrostatic fields of the upper layers, and micrometeors (R. 15).

In the cosmic ray studies the relative number of various nuclei are counted. In particular, the study will determine the relative quantity of lithium, beryllium, and boron nuclei, and those with fairly large charges. The equipment carried by the satellites will also serve to study the variation in the total flow of cosmic rays for 12-hour, for 24-hour, and for 27-day periods. (The 27-day period appears to be based on the fact that the Soviets expected the power sources of Sputnik I to last for 27 days. Actually, the power sources lasted for only 24 days.) (R. 15.)

In addition to data received from instruments within the satellites, information can be obtained on position and velocity of the satellites from observation of the Doppler effects at the point of reception. This was obtained by recording on a magnetic tape the change of tone of beats between the frequency of radio waves emitted by the satellite and the frequency of the heterodyne in the receiver. By using extremely stable frequency generators (such as molecular generators) for purposes of comparison, the velocity of the satellite can be determined with an accuracy of up to 0.01 percent (R. 10, 13, 18, 20).

The design of the radio antennas of the satellites makes it possible to determine the rate of rotation of the satellites which does not exceed a few r. p. m. In Sputnik II the tumbling motion requires about 20 seconds to complete the cycle. The rate of rotation is detectable because the antennas of the ground stations are designed to receive linearly polarized signals and a signal attenuation is obtained when antennas of the satellite radiate waves with circular polarization. This arrangement guarantees reception for any attitude of the satellite with the exception of the case where the plane of the satellite antennas passes through the receiving point and is perpendicular to the direction of polarization of the ground antenna (R. 10, 20).

The two sputniks have also provided considerable information on the ionosphere in respect to radio wave propagation. Heretofore, basic information on the ionosphere was obtained by radio waves transmitted from earth and reflected by the ionosphere. Reflections obtained in this manner were chiefly from the lower layers and not from the maximally ionized layers. The upper limit of the ionosphere could not be determined by this method. The two frequencies emitted by the satellite have different refraction angles and this fact has supplied data on the structure of the upper layers which was not previously available (R. 15, 20).

The results obtained with the 15-meter waves show that reception substantially exceeds the area of direct visibility. In some cases reception distances were 10, 12, and even 15 thousand km. Value of information on ionospheric radio wave propagation is further enhanced by the fact that the orbits of the sputniks are eliptical and they pass below, through, and above the F_2 layer of the ionosphere. When the satellite was above the F_2 layer, radio waves penetrated the entire thickness of the ionosphere, bounced off the earth's surface and spread further by single or multiple reflections from the F_2 layer in areas where its critical frequencies have sufficiently high values. It also appears that radio waves, incident upon the ionosphere from above at an oblique angle, are refracted to a considerable degree and thus penetrate beyond the line-of-sight distance (R. 19, 20).

When the satellite is below the F_2 ionization maximum and is approaching the observation point from the sunlit area of the earth, the 15-m. signals arrive at the reception point after successive reflections from the F_2 layer and the ground. However, after the satellite passes the observation point and proceeds into the unlit area of the earth, the reception is limited to the line-of-

sight distance. In a number of cases, unsymmetrical reception pattern was observed. The proximity of the satellite to the F_2 ionization maximum is believed to create exceptionally favorable conditions for the formation of waveguide channels which carry radio signals over very large distances. There is evidence that along with the satellite signals which have traversed the shortest distance, observation stations sometimes receive signals which have circled the world. This type of radio-echo was picked up on the 15-m. wavelength by Yu. N. Prozorovskiy (one of the most experienced short-wave amateurs of the U. S. S. R.) at 00: 07 hours on October 8, 1957, in Moskva (R. 19).

The 7.5-m. signals have been, as a rule, received within the line-of-sight distance. However, 7.5-m. waves can spread beyond the line-of-sight distance due to high critical frequencies of the F_2 layer in daytime (R. 19).

SECTION 11—RECEPTION OF SIGNALS FROM SPUTNIKS

An exclusive radio monitoring program has been organized in the U. S S. R. In addition to a large number (60 according to one source) of professional radio observation stations equipped with radar and radio direction finders, the U. S. S. R. has a large amateur observation program. The amateur program is centered around some 26 or 28 DOSAAF radio clubs, some of which possess a large quantity of high-quality radio observation equipment. In addition, the satellites were observed by a large number of radio amateurs with the aid of specially built radio receivers. Diagrams of these receivers and of direction-finding attachments have been published in 1957 in various issues of the Soviet magazine "Radio" (R. 10, 15, 16, 21).

In order to receive signals heterodyne receivers have to have a sensitivity of 1–3 microvolts. The 40-megacycle signal is expected to be more reliable so that amateurs are encouraged to use receivers of the 38–40-megacycle frequency of the types described in the periodical "Radio" (R. 11).

Half-wave dipoles as well as loop antennas, of the type used for television, can be utilized for the reception of signals from a satellite. To obtain the necessary directional pattern, the antenna is suspended a quarter wavelength above the ground, or metal roof, which serve as reflectors. Reception is best in the planes perpendicular to the antenna. Since no broad-band characteristic is required from these antennas, the dipoles can be made from tubes or even from soft wire, suspended on two isolating stretcher cables. Ordinary lighting cord may be used as a feeder, but in case of considerable length it is desirable to use high-frequency cable matched to the antenna (by means of a U-bend) and to the input of the received (R. 13).

A simple 300-ohm antenna can be made from the KATV–300 television cable. Antennas must be set up in the North-South direction (R. 13).

SECTION 12—MONITORING PROCEDURE

In order to be of maximum value, observations should be recorded on tape together with the exact time of passage of the satellite. The receiver should be turned on well ahead of time in order to stabilize the oscillator frequencies. An intermittent signal of 0.2- to 1.5-sec. period may announce the approach of the satellite. The signal strength increases gradually to attain a certain maximum and then gradually fades away. The duration of observation may vary from 5 to 15 minutes depending on the sensitivity of the receiver. It is important to record the exact time of the beginning, the peak, and the fading of the signal (R. 13).

Tape recordings of the observation will be especially valuable. If, in addition, the exact time of observation is fixed, the tape becomes an important document to determine the exact time of passage of the satellite over certain points. The time of passage of the satellite nearest to a given point can be determined from the change of strength of the received signal. Maximum signal strength will correspond to the shortest distance to the satellite. Despite its simplicity, however, this method fails to give accurate result due to fadings of the signal in the ionosphere (R. 13).

A much more exact method for determining time of passage is based on the frequency shift due to the Doppler effect. In this case, it is important that the oscillator frequency remain constant within a score of cycles (the frequency of the satellite transmitter being quartz-controlled). To achieve this it would be necessary to stabilize the receiver oscillator frequency by quartz crystal, or by very careful parametric adjustment. It is simpler, therefore, to use a con-

ventional receiver and a separate oscillator for the frequency of 40 Mc±2 Kc. such as the KK–6 quartz calibrator. In this case the receiver oscillator is switched off and tape recorder is made to record beats formed by the received signal and the calibration frequencies (R. 13).

For this purpose, the terminal marked "coupling" of the calibrator is weakly coupled with the antenna input of the receiver. This method eliminates frequency shifts of the heterodyne oscillator, since the beats are the result of two stabilized frequencies. Both frequencies must be within the frequency band of tuned receiver. Assuming that the exact frequency of the transmitter is 40.022 Mc., the 32d harmonic of the KK-6 calibrator (40,000 Mc.) will be nearest to the signal. The amplitude of this harmonic at the calibrator output is very low, but it will be amplified along with the signal to a level which renders detected beats strong enough for tape recording (R. 13).

Before observation begins the receiver is tuned to 40.000 Mc. with the quartz calibrator. The tape recorder should be turned on as soon as signals from the satellite become audible. Time marks must be recorded on the tape along with signals in order to determine the time of passage. It is possible that special time signals will be broadcast for the purpose. If not, it is necessary at the end or recording to dictate into the recorder the exact time in hours, minutes, and seconds. The clock, of course, must be checked by time signals. The preferred frequency for determining the time of passage by the Doppler effect is 40 Mc. On this frequency the effect is much more pronounced than on the 20 Mc. frequency (R. 13).

The purpose of ionospheric observations is to determine the strength of receiving signals. Measurements are made at the output of the receiver by means of the IV–4 output meter or by a VTVM such as a TT–1, VKS–7, and others. The 20 Mc. signal should be used for this since it is more sensitive to ionospheric phenomena. However, by recording the output readings of both receivers simultaneously, it is possible to obtain information about the ionosphere. The information can be recorded on a single tape. In playback the output of the receiver is connected to an oscillograph. The amplitude of each signal can be measured directly on the screen. The high-frequency signals should not fall into the roll-off section of the frequency curve of the receiver. Shifts in the relation of the short wave signal to that of the ultra-short wave, reflect a change in conditions of wave propagation due to the ionosphere. In this experiment antennas should be placed sufficiently apart from each other (not less than 5–10 meters), to avoid mutual interference between short wave and ultra-short wave signals. Antennas should be oriented in the north south direction (R. 13).

SECTION 13—SUBMISSION OF DATA

The Radio Engineering and Electronics Institute of the U. S. S. R. Academy of Sciences has been designated as a central collecting and processing point for data received from the sputniks. All radio amateurs participating in the observation program have been asked to send descriptions of radio equipment used along with data and magnetic tapes of the recorded signals to the above institute at No. 11 Mokhavaya Street, K9, Moskva (R. 12).

In order to obtain maximum utility from the observations and to simplify processing and analysis of observations, the participants are requested to submit their data in accordance with the following outline:

A. *Place, date, and time of observation.* Time should include beginning of reception, termination of reception, and moment of greatest signal volume, all recorded *in terms of Moscow* time.
B. *How time was recorded* (by ordinary watches, by calibrated watches, or by radio time signals).
C. *Frequencies of received signals.*
D. *Reception characteristics* (fading and disappearance of signals).
E. *Rate of key modulation.*
F. *Time of passage thru equisignal zone* (when a direction finder is used) or time of *maximal passing* (when Doppler effect is used).
G. *Meteorological conditions* at the time of reception (cloudiness, rainfall, etc.).
H. *Type of receiving equipment* (detailed description).
I. *Type of antenna and location of its installation* (surrounding objects).
J. *Type of tape recorder and speed of recording tape* (in mm/sec.).
K. Last name, first name and patronymic, radio amateur rating, and exact address of observer (R. 12).

It also requested that after termination of signal reception a brief message concerning location of reception, date, time (Moscow time), and signal frequency be immediately sent by wire to following cable address: Moskva-Sputnik (R. 12).

SECTION 14—VISUAL OBSERVATION PROGRAM

Observation of the sputniks is also carried out systematically by 66 visual observation stations and two observatories in the U. S. S. R.. To this number should be added some 30 foreign observatories. In November 1957 a network of visual observation stations was being built in Soviet satellite countries. In addition thousands of amateur observers are participating in the program. In the U. S. S. R. amateur astronomers have a large amount of high-quality wide-angle telescopes specially built for this purpose. Observation stations have equipment for determination of satellite position at a given time. This equipment permits optical stations to fix bearings to an accuracy of one degree and to fix time to an accuracy of less than one second. Each of the optical stations in the U. S. S. R. also maintains one or two "optical barriers" which consist of telescopes situated on the meridian capable of traversing along the vertical circle perpendicular to the visible orbit of the satellite. In addition the satellite is located by a method based on "local time rule." The satellite orbit does not participate in the daily rotation of the earth and the satellite itself passes over the given latitude in local sidereal time which slowly changes during the rotation of the orbit in absolute space around the earth axis because of deviation of the gravitational field (R. 15, 20).

SECTION 15—FUTURE PLANS: POWER SUPPLY

Having succeeded with their first two satellites, Soviet scientists and engineers are looking forward to future projects. Their press is full of plans for trips to the moon, Mars, and other planets. Their attention is often turned to specific problems such as development of remote-controlled equipment for exploration of the surface of the moon, calculation of rocket trajectories, and use of photonic propulsion in space.

The future development of artificial satellites of the earth will to a considerable extent, depend upon the successful solution of the problem of power supply for uses other than propulsion. The most obvious primary source in this respect is, of course, solar energy. Future satellites will, therefore, have their electric storage batteries recharged with solar energy, the conversion agent being based upon either photo- or thermo-electric principles. Incidentally, this method has not yet been used in the first Soviet sputnik. Thermonuclear energy sources are not being considered feasible for artificial satellites at the present time (R. 9, 38).

Photoelectric generators consist of a flat aluminum plate coated with a thin layer of silicon. One sq. meter of such a plate generates up to 50 watts of electric power. Since the plate must face the sun, it will have a special solar tracking device maintaining the plane of the generator at right angles to the solar rays. DC to AC conversion can be accomplished with semiconductor devices operating at 90% efficiency.

At the present time, photoelectric generators are in experimental stage of development. One of the test models was recently shown at the exhibit of the Academy of Sciences; its efficiency, however, is only 5%. The photoelectric cell, weighing 20 grams, generates a current of 50 milliamperes at 2.5 volts. At the exhibit, this generator operated on light from electric lamps and powered a miniature electric motor. Silicon photoelectric generators break down, however, after prolonged exposure to sunlight, and better materials should be developed.

Thermoelectric generators are based on the thermocouple principle. A battery of thermocouples is heated by convex mirrors. A generator weighing 110–115/kg. can supply power of about 100 watts (R. 38).

Another source of solar energy derived from molecular dissociation at high altitudes. Solar radiant energy at elevations of 30–40 km. is 10 times as high as on the surface. A small part of this energy is reflected by the atmosphere which, however, absorbs the bulk. The reason that the temperature of the atmosphere does not rise several thousand degrees is that solar energy is expended on breaking down, splitting, and dissociation of gas molecules. Molecules of nitrogen, oxygen, and other components of the atmosphere, are broken down into atoms. At night, the atoms reform into molecules and gradually release the energy which was used in their dissociation. Each kilogram of atomic oxygen

as it reforms into molecular oxygen liberates 3,700 megacalories of heat. By means of certain inhibitors which retard the formation of molecular gas, compressed gases of the atmosphere can be maintained in atomic state in cylinders. This process can be reversed by means of catalysts which accelerate the formation of molecules a thousandfold and release vast amounts of energy. These catalysts were discovered only recently in the 1950's. It is assumed that in the near future this type of solar fuel will become available by compressing atmosphere in stations situated at 30–40 km. altitudes (R. 34).

SECTION 16—FUTURE PLANS: PROPULSION

The future development of space travel cannot rely upon chemical fuel because of its limitations. Dr. J. Gadomski of Poland, wrote in the latter half of 1957 that chemical fuels at best can launch a 50-kg. satellite to a height of 1,000 km. Although the subsequent sputnik launchings cast a doubt upon this statement, it is obvious that further space research must turn to other, unconventional forms of propellants. The ultimate space vehicle, frequently discussed in the Soviet popular scientific press, seems to be the "photonic rocket." According to the above Dr. Gadomski, chemical fuel can produce exhaust gas velocities of up to 3.5 km./sec. Atomic energy can boost this speed up to tens of thousands of km./sec. The real promise of space travel, however, is offered by the photonic rocket powered by a nuclear "lamp", as suggested by Sanger of the Nuclear Fuel Research Institute in Stuttgart. The photonic rocket consists of an accelerator of particles, an accelerator of anti-particles, fuel storage, and reflector in whose focus the particles and antiparticles annihilate each other producing photons (R. 22).

Prof. G. I. Babat, an industrial electrical specialist and author of popular scientific books, implies that photonic propulsion may be realized in the next 40 years. Photonic rockets, according to Babat, will depend on a stream of electromagnetic quanta reflected from the walls of the reaction nozzle. The difficulty inherent in this concept is the fact that even ideal reflectors absorb some fraction of the incident radiant energy. The magnitude and intensity of the photon stream required to propel a rocket is so great that the mirror would be vaporized in a fraction of a second if light of the visible spectrum were to be used. However, this difficulty can be circumvented by the use of centimeter waves of the electromagnetic spectrum. The lower energy quanta of centimeter waves are absorbed by mirror surfaces to such a small extent that it becomes possible to use them for propulsion of photonic rockets (R. 34).

SECTION 17—FUTURE LAUNCHING AND REENTRY METHODS

According to N. A. Varvarov, Chairman of the Astronautics Section of the Central Aeroclub of the U. S. S. R., the launching of an artificial satellite of the earth could be accomplished as follows: The launching vehicle would comprise a carrier aircraft, an accelerating aircraft, and a final stage rocket in that order. Each succeeding vehicle of that order would be carried piggy-back fashion on the preceding vehicle. The carrier aircraft would carry the system to a certain altitude whence, having released the accelerating aircraft with the rocket, it would return to earth. The accelerating aircraft would continue to gain altitude, release the rocket, and also return to earth. The rocket would place the satellite directly in its orbit. During each state, power would be supplied by the carrying vehicle only (R. 6).

According to another method, turbojet engines suspended under the large wings of the carrier rocket may be used for the takeoff and the subsequent flight through the denser layers of the atmosphere. After the altitude of 20–25 km. and speed of about 2,000 km./hr. have been reached, the turbojet engines will be jettisoned, the next stage of propulsion being taken over by more economical for these speeds ramjet engines.. These will lift the carrier rocket to the altitude of 35–40 km., where it will have a speed of about 5,000 km./hr. At this point, the ramjet engines will fall off together with the no longer necessary wings. Further stages of the flight will be carried out under the power of liquid-fuel rocket engines of the carrier rocket which may be of a single- or multi-stage design.

These methods of satellite launching can be used not only in conjunction with current energy sources, liquid fuels, but also when atomic engines will be available (R. 6).

The descent of the satellite and recovery of the results of observations (exposed photographic film) are possible, although this requires additional equipment. According to one project, the third stage of the rocket carries a collapsed sphere made of thin metal insulated by several layers of protective coatings. The exposed film cartridge is placed inside the sphere which is then filled with bottled helium. The film cartridge is also protected from heat by special coating. The falling speed is retarded by a small braking rocket also installed in the third stage carrying instruments and the remaining apparatus. The inflated sphere descends like a parachute and reaches the earth's surface intact. Another project provides for a satellite with wings to make it glide safely to earth. To increase the visibility of the satellite, it was suggested that it emit sodium vapor which shines with bright light when exposed to sunlight. (R. 31).

SECTION 18—FUTURE PLANS: MOTION IN SPACE

Soviet authors are widely discussing space travel based on the utilization of the gravitational fields of the planets and the ballistic motion of the space ship. A project making a direct use of this idea has been credited to a Leningrad scientist, G. Chebotarev, who proposed to send a noncontrolled ballistic rocket to the moon, claiming that this will require merely 16 tons of fuel instead of the expected hundreds of tons. The trajectory for such a ship has been computed by the Institute of Theoretical Astronomy of the Academy of Science of the U. S. S. R. which estimated that the ship could be brought to round the moon at a sufficiently close distance and return to earth. According to calculations, the rocket without fuel, i. e., the apparatus and instruments enclosed in a spherical shell, should weight 50–100 kg. (R. 28, 30).

The Institute, located on Vasil'yevskiy Island in Leningrad, is the world's only specialized institution devoted to the detailed study of the motion of celestial bodies. Using large automatic computers, the Institute analyzes the motions of the earth, moon, and other planets of the Solar system and those of the largest and brightest stars. These computations serve as a basis for the publication of special astronomical calendars (astronomical ephemerides) specifying the position of celestial bodies at any time.

The first trajectory of a ballistic rocket, which the Institute succeeded in computing, would bring the rocket in five days to a distance of less than 30,000 km. from the moon and return it to earth. The maximum distance of the rocket from the earth reaches 416,000 km. Since the moon is 384,000 km. away from the earth, the rocket in this trajectory can round the moon. At this point, the speed of the rocket will decrease almost to zero, leaving it in the vicinity of the moon for over two days during which time it can investigate the hemisphere of the moon invisible from the earth, by means of its automatic instruments. The return flight to the earth will also take about five days. The landing will be accomplished by parachute or a glider device.

Uncontrolled (ballistic) interplanetary ship can obviously travel in space without the expenditure of fuel along more complex trajectories, for example to Mars and back. The Institute is computing a Mars trajectory for a ballistic rocket (R. 30).

Another organization engaged in work of this type has been the Mathematical Institute of the Academy of Sciences of the USSR which during the period 1953–1955 carried out a systematic investigation of a cycle of problems involving the theory of flight to the moon. These problems involved the form and classification of trajectories along the ballistic section of the path, possible trajectories circling the moon with return to earth, minimum intial speeds required to reach the moon, and the effect the scattering of initial data has on the various trajectories. The Institute performed a series of numerical computations using a high-speed electronic digital computer (R. 25).

Plans for a trip to Mars, claimed to be underway in the Soviet Union and abroad, specify ten space ships of 1,700 tons each to be launched from an intermediate satellite station. The ships are to be launched from the circular orbit of the station into an orbit leading to Mars using the gravitational force of the sun instead of fuel. The trip there will take 256 days. The crew will have to wait on Mars until a convenient mutual position of Mars and earth will allow for starting the return flight. The waiting period is 440 earth days. The entire trip will take 952 days. It is thought that flights of this type will be possible by the end of this century (R. 2).

SECTION 19—SOVIET SPACE TIMETABLE

At the present time, there is a practical basis for a discussion of a device capable of reaching the moon. Further development and improvement of artificial satellites should, at first, increase their dimensions and weight to accommodate more powerful energy sources for communications and scientific instruments. To increase the effectiveness of observations, the satellite should have a capability for assuming definite attitudes in space. Consequently, it should be provided with facilities for automatic control of its motion.

In the next stage of development, radio-controlled satellites will be created with motors and fuel supply. By switching the automatic motor on or off, the rocket will be transferred from one orbit to another. It should also be desirable to have automatic devices capable of braking the rocket at the entry into the denser layers of the atmosphere where it would be allowed to glide. This would secure the return of the satellite to the earth, increasing the value of scientific observations.

When the rockets will have well controllable engines, when crews of pilots trained in withstanding weightlessness will be available, when good space suits will be produced, then man will appear in the rockets and satellites. Manned rocket-satellites will be able to change trajectories and approach each other. Men will emerge on the surface of their ships, making it possible to create large cosmic stations orbiting around the earth, described so long ago by K. E. Tsiolkovskiy. The cosmic stations may be used for the assembly of interplanetary ships.

The interplanetary space, however, will be first probed by radio-controlled ships. In particular, it is assumed that the first flights to the moon will be accomplished by pilotless rockets equipped with automatic devices for photographing the invisible side of the moon and for the transmission of the images to the earth. It is also possible to build various robot devices capable of moving from the space ships to the moon surface to carry out observations and to transmit the results to the earth (R. 45).

An outline of the approximate timetable of space conquest was given by V. V. Dobronravov, a committee chairman of the Astronautics Section. The future of astronautics can thus be divided into three periods: The first, to be marked by the launching of radio-controlled pilotless rockets to an altitude of 300–400 km., capable of realization at the present time. The second period will witness the building of a manned satellite of the earth, about the year 1975, and will terminate in a flight around the moon without landing (1980–1990). The first space flight to the moon with landing and return to earth will usher in the third period around the year 2000. Dobronravov regards this as a very conservative estimate (R. 21a).

Although Dobronravov's article was written in 1954, his target date of 1975 was still closely approximated three years later, in a 1957 Soviet popular scientific article. This time, predicting the first manned flight to the moon for 1974, the article states that the rocket will be powered by the thrust of water heated by an atomic reactor (R. 28).

Academician A. A. Blagonravov claims that the U. S. S. R. now has a rocket which is capable of reaching the moon. However, for the moment, such a rocket will not be able to return to earth (R. 33).

SECTION 20—GENERAL RESEARCH PROJECTS

One of the important aspects of space travel development is the opportunity it affords for scientific research which would be extremely difficult or impossible within the limits of the lower atmosphere. A portion of the space effort is thus related to the program of the International Geophysical Year. During the IGY, the U. S. S. R. will launch over 100 rockets for extensive sonding the upper layers of the atmosphere not only in central latitudes but also in the Arctic and Antarctic. The rockets will be expected to reach altitudes of several hundred km. Launchings will be carried out on "world days" and during periods of special solar activity. The launching pattern is as follows: From the Arctic and Franz-Joseph Land—25 rockets in 1958; from the mean latitudes of the U. S. S. R.—30 in 1957; from the Antarctic (mainly from the area of Mirnyy Station)—30 in 1957 and 1958. A series of artificial satellites of the earth will be launched, involving a wide scientific program. To clarify special questions, the use of anthropoid monkeys, rodents, mollusks, and insects will be needed.

Insects will afford a convenient opportunity for genetic research (R. 46, 43, 33, 23, 21).

V. L. Ginzburg, corresponding member of the Academy of Sciences of the U. S. S. R., suggested the use of an artificial satellite of the earth for experimental checking of the general theory of relativity and, specifically, for checking the displacement of the perigee of the satellite itself, a measurement of the gravitational displacement of the radio frequency transmitted by the satellite, and a measurement of the intensity of luminescence of the metalalaxy from the satellite (R. 9).

Work is also underway on the means of exploring the surface of nearest planets. A concentrated effort in this direction has been made by Yu. S. Khlebtsevich, chairman of the Committee for Radio-Telecontrol of the Astronautics Section. Khlebtsevich specialized in the problems of remotely controlled mobile laboratory devices. The concept of unmanned automatic mobile equipment investigating the surface of a planet seems to him to be the only realistic way of exploration. It is claimed that in the course of his research, Khlebtsevich found new methods of controlling space rockets over large distances, solved the problem of fixing the coordinates of the rocket with respect to the planets, and obtained many other technical solutions. This work, he feels, permits him to conclude that the initial investigation of space, as well as the moon, Mars, and Venus, will be feasible in the nearest future at an economically reasonable cost. The use of automatically controlled unmanned vehicles eliminates the basic difficulties of space travel: space flight biology, passenger protection, space ships, shields, etc. There is no longer the need to return the equipment to earth. The rocket is lightened to such an extent that its design and construction become practically feasible now, prior to the solution of problems connected with the development of atomic engines (R. 29).

The problem of highly advanced automatic exploring devices has been considered by the Institute of Automatics and Telemechanics of the Academy of Sciences of the U. S. S. R. These devices are a new type of automatic mechanisms, called self-organizing and self-tuning systems, designed for the performance of specified operations under unspecified conditions, and capable, in each case, of selecting the best solution of a given problem among a set of alternatives. The mechanisms have memory storage devices and can analyze their actions. At the present time, such machines are just beginning to be built. It is of considerable interest, therefore, to study the models of such systems. One of the first men to build such models is the English scientist Grey-Walter, who called his models, "turtles." The Soviet Institute of Automatics has also built a model of such an automatic machine, specially designed for the exploration of the surface of planets (R. 32).

Another significant aspect of space development is the use of artificial satellites as television relay station in a satellite has for a long time attracted the attention of specialists; it was the subject for a discussion at a scientific-technical conference in 1953. The problem of centralized television broadcasting over a large area in the U. S. S. R. has now become capable of solution. It is claimed that within a few years Moskva television broadcasts will be received as far beyond Soviet Union borders as China or the Antarctic. This will probably necessitate a heavier satellite orbiting at an altitude of over 35,000 km. The orbit and velocity of the satellite will be selected so as to keep it stationary over a desired area of the earth's surface (R. 36).

SECTION 21—ORGANIZATION OF THE SOVIET SPACE EFFORT

Since April 1955 the overall coordination of the Soviet space effort has been vested in the *Permanent Interagency Commission for Astronautics*. This commission has been set up under the auspices of the *Astronomic Council* of the Academy of Sciences of the U. S. S. R. Academician Leonid Ivanovich Sedov was named chairman of the Astronautics Commission (R. 8, 27a, 49).

The Astronautics Commission is composed of a number of outstanding scientists and engineers such as P. L. Kapitsa, V. A. Ambartsumyan, P. P. Parenko, B. V. Kukharkin, and others. A. G. Karpenko is the Learned Secretary of the Commission (R. 49).

The Soviet Astronautics Commission has been active on the international scene. In 1955, it sent two observers (L. I. Sedov, and Prof. K. I. Ogorodnikov) to the VIth Congress of the Astronautical Federation. In 1956, the Soviet Astronautics Commission became a member of the Astronautical Federation and L. I. Sedov was elected vice-president of the Federation. In 1957, the

Soviet Astronautics Commission sent four delegates (L. I. Sedov, A. G. Karpenko, Alla T. Masevich, and Dr. Lidiya V. Kursanova) to the VIIIth Congress of the Federation at Barcelona (R. 2a, 2b).

A. G. Karpenko has pointed out that the Soviet Astronautics Commission is concerned not only with the current effort involving high altitude rockets and artificial satellites but that it is looking forward to interplanetary travel and exploration. At present one of the major tasks of the Astronautics Commission consists of working out and building of mobile, automatic and remote control laboratories for exploration of the moon and the nearer planets. The function of the Commission in this task is that of coordinator of the space effort. The actual work is performed by a number of scientific and technical organizations (R. 49).

Not all of the organizations involved in the Soviet space effort have been identified, but some of the organizations involved are listed below:

1. *Institute for the Study of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation* of the Academy of Sciences of the U. S. S. R.

   This institute plays a leading role in the collection of data and solution of theoretical problems related to the space effort (R. 35).
2. *Institute of Applied Geophysics* of the Academy of Sciences of the U. S. S. R.

   This institute has played an important role in the design of instruments and equipment for the study of the upper ionosphere (R. 27).
3. *Institute of Theoretical Astronomy* of the Academy of Sciences of the U. S. S. R.

   The function of this institute is the calculation of orbits and life spans of existing and future Soviet sputniks and space rockets (R. 30).
4. *Institute of Radio Engineering and Electronics* of the Academy of Sciences of the U. S. S. R.

   This institute has been designated as a central point for collection and evaluation of all data received from sputniks by radio (R. 12).
5. *Institute of Automatics and Telemechanics* of the Academy of Sciences of the U. S. S. R.

   This institute has been responsible for working out programming mechanisms on the sputniks. It is currently engaged in the problem of developing robots for remote control exploration of the moon, Mars, and Venus (R. 32).

In addition to the scientific institutes listed above a significant role in the Soviet space effort has been played by the *Astronautics Section* of the Central Aeroclub imeni V. Chkalov. This is part of the DOSAAF organization and its function appears to be the stimulation of interest in astronautics among the young people of the U. S. S. R. Its structure and the calibre of its personnel, however, suggests that this Astronautics Section may be performing a more important function. It may even be in charge of research and development of certain aspects of the Soviet space effort (R. 8, 47a).

The Astronautics Section of the Central Aeroclub appears to have been founded early in 1954 or late 1953. N. A. Varvarov was the chief of section. The section had been organized into a number of scientific-technical committees each headed by an expert in the fields. The committees follow:

1. *Cosmic Navigation* (A. A. Shternfeld and V. V. Dobronravov)
2. *Rocket Engineering* (I. A. Merkulov)
3. *Space Medicine* (A. D. Seryapin)
4. *Astronomic and Physical Problems* (K. P. Stanyukovich)
5. *Radio and Telecontrol* (Yu. S. Khlebtsevich) (R. 21a, 29).

The Astronautics Section is still in operation; Varvarov is still chief of section. The section is still actively working on the problems of space flight (R. 29).

SECTION 22—PERSONNEL IN THE SOVIET SPACE EFFORT

The names of Soviet scientists and technical experts listed below are all involved, in one way or another, with rocketry, artificial satellites, ionosphere studies, and other problems related to the Soviet space effort. The names of personnel and information have been obtained only from the articles used for this report. No special search for additional names or additional information about names already known has been made. But there is little doubt that additional information could be obtained, if requested.

1. AMBARTSUMYAN, V. A.: Member of the Permanent Interagency Astronautics Commission of the Academy of Sciences of U. S. S. R. and President of the Academy of Sciences of the Armenian SSR (R. 49).
2. BABAT, G. I.: Professor of Electrical Engineering and Doctor of Technical Sciences. Has written both technical and popular articles on uses of electricity. Proponent for use of photonic propulsion for space rockets (R. 34).
3. BELOUSOV, V. V.: Doctor of Physical and Mathematical Sciences. Corresponding member of the Academy of Sciences. Director of Institute of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation (R. 2b, 7).
4. BLAGONRAVOV, A. A.: Academician. Secretary of Department of Technical Sciences of the Academy of Sciences of the U. S. S. R. He is a professor and one of the top Soviet specialists on rockets and space flight. He participated in the designing of the sputnik rockets. In the summer of 1957 he claimed that the U. S. S. R. had a rocket capable of reaching the moon (R. 5a, 21, 33).
5. CHEBOTAREV, G.: Professor of Astronomy. Doctor of Physical and Mathematical Sciences. Associated with the Institute of Theoretical Astronomy of the U. S. S. R. Academy of Sciences. He is a specialist on motions of celestial bodies. Works in Leningrad. Proposed 2 projects for sending a ballistic rocket to the moon, which would require only 16 tons of fuel, instead of hundreds of tons, as generally estimated (R. 28, 30).
6. CHUDAKOV, A. Ye.: Specialist on cosmic radiation associated with working on data obtained via the sputniks (R. 26).
7. DANILIN, B. S.: Specialist on upper atmosphere. Has been working on problem of exploring the structure of the upper layers of the atmosphere with aid of sputniks (R. 26).
8. DOBRONRAVOV, V. V.: Doctor of Physical and Mathematical Sciences. Chairman of the Cosmic Navigation Committee of the Astronautics Section of the Central Aeroclub imeni V. Chkalov. Specialist on rockets and author of books and articles on space flight (R. 21a, 37b, 44a, 55).
9. DOLGINOV, S.: Magnetologist. Candidate of Physical and Mathematical Sciences. Currently working on the problem of probing the external magnetic field of the earth by means of rockets and artificial satellites (R. 42).
10. ENEYEV, T. M.: Specialist in celestial mechanics. Currently working on calculation of orbits, lifetimes, and fuel required for placing of artificial satellites into orbit (R. 25).
11. FEDOROV, Ye. K.: Geophysicist. Corresponding member of the Academy of Sciences of the U. S. S. R. Member of North Pole–1 Drifting Station in 1937. Hero of the Soviet Union. In April 1939 he became Director of the Arctic Institute (Leningrad). In December 1939 he became Chief of the Hydrometeorological Service of the U. S. S. R. In 1954 he was a consultant to the High Latitude Expedition of that year. In 1957 he was working at the Institute of Applied Geophysics. He is associated with research on upper atmosphere by means of high altitude rockets (R. 9).
12. FESENKOV, V. G.: Engineer. Collaborated on assembly of Sputnik I (R. 21).
13. FRADKIN, M. I.: Cosmic ray specialist. Engaged in study of primary cosmic radiation as collected via the artificial satellites (R. 25).
14. GADOMSKI, Jan: Professor of Astronomy. President of Warsaw Astronautics Society. Working on project of photon propulsion of rockets (R. 22).
15. GALKIN, G. N.: Physicist. Working on project of perfecting solar-silicon batteries for use as power sources for artificial satellites. (R. 25).
16. GINSBERG, V. L.: Physicist. Working on composition of primary cosmic radiation. Has theory of using artificial satellites for the purpose of proving the general theory of relativity. Has written a serious technical article article on this subject (R. 25).
17. GRINGAUZ, K. I.: Physicist. Working on concentrations of positive ions in the orbit of the artificial satellite of the earth (R. 26).
18. IMYANITOV, I. M.: Physicist. Working on measurement of electrostatic fields in the upper layers of the atmosphere of the earth (R. 26).
19. ISAKOV, P.: Chairman of Scientific-Technical Committee for Space Medicine of the Astronautics Section of the Central Aeroclub of DOSAAF (R. 46).
20. KAPITZA, P. L.: Academician. Outstanding Soviet physicist. Member of the Presidium of the U. S. S. R. Academy of Sciences. Member of the Permanent Interagency Commission on Astronautics (Space Travel) of the Astronomic Council of the U. S. S. R. Academy of Sciences (R. 49).

21. KARPENKO, A. G.: Academician. Learned Secretary of the Permanent Interagency Commission on Interplanetary Travel (Astronautics) of the Astronomic Council of the Academy of Sciences of the U. S. S. R. Was sent by the Astronautics Commission as a delegate to the VIIIth Congress of the Astronautical Federation in Barcelona in 1957 (R. 2a, 27a, 49).
22. KATAYEV, S.: Television engineer. Is working on the problem of building a television and radio receiving and rebroadcasting station sufficiently compact and shockproof to be placed into orbit around the earth (R. 36).
23. KAZANTSEV, A. N.: Doctor of Technical Sciences. University professor whose specialty is propagation of radio waves in the ionosphere. Has written articles on propagation of radio waves from the satellites (R. 19, 37aa).
24. KHAYKIN, S.: Professor. Has worked on determination of velocity of artificial satellites by means of Doppler effect. (R. 18).
25. KHLEBTSEVICH, Yu. S. Candidate of Technical Sciences. A young expert on guided rockets. Since at least 1954 he has been chairman of the Scientific-Technical Committee for Radio-Telecontrol of the Astronautics Section of the Central Aeroclub in V. Chkalov. For several years now he has been working on a project for sending remote controlled radio and television equipped robot laboratories to the moon and the nearer planets. (R. 7a, 21a, 29).
26. KUKARKIN, B. V.: Doctor of Physical and Mathematical Sciences. University professor. Member of Astronomic Council of the Academy of Sciences. Member of Permanent Interagency Commission on Interplanetary Travel (Astronautics) of the Astronomic Council of the Academy of Sciences of the U. S. S. R. (R. 41, 49).
27. KURNOSOVA, Lidiya V. (woman); Soviet radiation research expert. She was sent by the Astronautics Commission of the Academy of Sciences as a delegate to the VIII Congress of the International Astronautical Federation in Barcelona in 1958. She is currently studying the composition of primary cosmic radiation. (R. 2a, 25).
28. LANDSMAN, A. P.: Physicist. Working with Dr. Vavilov on project of perfecting solar-silicon batteries for use as power sources on artificial satellites. (R. 25).
29. LOGACHEV, Yu. I.: Radiation specialist. Currently working with S. N. Vernov on data (obtained by artificial satellites) on variations in cosmic radiation. (R. 26).
30. LYAPUNOV, Boris V.: Popular writer on rockets and space flight. (R. 31).
31. MALOVETSKAYA, B. M. (woman): Physicist. Working with Dr. Vavilov on a project of perfecting solar silicon batteries for use as power sources on artificial satellites (R. 25).
32. MANDEL'SHTAN, S. L.: Physicist. Working on high frequency solar ultraviolet rays (R. 26).
33. MASEVICH, Alla G. (woman) (the anglicized form of the name is MASSEVICH): Astronomer. Academician. Deputy Chairman of the Astronomic Council of the Academy of Sciences of the U. S. S. R. Was sent to VIII Congress of the International Astronautical Federation in Barcelona as a delegate of the Permanent Interagency Commission on Space Travel (Astronautics) of the Astronomic Council. She is also very closely related to the visual (i. e. optical) observation stations for the Soviet satellites (R. 1a, 1b, 2a, 44).
34. MERKULOV, I. A.: Chairman of the Technical Scientific Committee for Rocket Engineering of the Astronautics Section of the Central Aeroclub imeni V. Chkalov (R. 21a).
35. MIKHNEVICH, V. V.: Candidate of Physical and Mathematical Sciences. Expert on upper atmosphere pressures. Currently working at the Institute of Applied Geophysics of the U. S. S. R. Academy of Sciences (R. 26, 27)
36. MIRTOV, B. A.: Stratospheric meteorologist. Specialist on composition of the upper atmosphere. Sent as delegate to recent Paris Conference on Upper Air Studies by means of rockets (R. 26).
37. MOSEVICH, A. (See MASEVICH above.)
38. NAZAROVA, T. N. (woman): Physicist. Currently engaged in studying solid components of interplanetary matter by means of rockets and artificial earth satellites (R. 26).
39. OGORODNIKOV, K. I.: Member of U. S. S. R. Academy of Sciences. Was sent to VIth Congress of the International Astronautical Federation (Copenhagen, 1955) as an observer for the Permanent Interagency Commission

for Interplanetary Travel (Astronautics) of the Astronomic Council of the U. S. S. R. Academy of Sciences (R. 2b).

40. OKHOTSIMSKIY, D. YE.: Specialist in celestial mechanics. Currently working on calculation of rocket and satellite orbits (R. 25).
41. PARENAGO, P. P.: Corresponding Member of the U. S. S. R. Academy of Sciences. Member of the Permanent Interagency Commission on Space Travel (Astronautics) of the Astronomic Council of the Academy of Sciences (R. 49).
42. PETROVSKIY, A. M.: Member of the Institute of Automatics and Telemechanics of the U. S. S. R. Academy of Sciences. Currently engaged in work on design of robot mechanisms for exploration of the moon (R. 32).
43. POBEDONOSTSEV, YU. A.: Professor. Doctor of Technical Sciences. One of the speakers at the official meeting organized by the Academy of Sciences on Oct. 16, 1957, to celebrate the successful launching of the first sputnik. He is interested in various aspects of astronautics and may be a member of the Permanent Interagency Commission on Space Travel (Astronautics) of the Astronomic Council (R. 41).
44. POKROVSKIY, A. V.: Director of Institute of Aviation Medicine. Has been in charge of high altitude experiments with dogs and other animals sent aloft in rockets. He is a specialist on space medicine. In December 1956 he attended the Paris Conference on Guided Rockets where he read a paper on jet propulsion (R. 3, 4, 8, 27b).
45. POLOSKOV, S. M.: Doctor of Mathematical and Physical Sciences. Specialist on upper air. Conducted studies by means of rocket sondes of the outer layers of the atmosphere (R. 3, 8, 26, 33).
46. RAZORENOV, L. A.: Nuclear physicist. Candidate of Physical and Mathematical Sciences. Has worked with S. N. Vernov on the composition of primary cosmic radiation. Recently wrote an article on "hyperons" (R. 6a, 25).
47. REPNEV, A. L.: Physicist. Has been working with B. S. Danilin on measurements of the upper atmosphere with the aid of satellites (R. 26).
48. SEDOV, Lonid I.: Academician. Chairman of the Permanent Interagency Commission on Space Travel (Astronautics) of the Astronomic Council of the Academy of Sciences of the U. S. S. R. Vice-President of the International Astrononautical Federation (R. 2a, 2b, 49).
49. SERYAPIN, A. D.: Chairman of the Scientific Technical Committee for Space Medicine of the Astronautics Section of the Central Aeroclub imeni V. Chkalov in 1954 (R. 21a).
50. SHAFER, Yu G.: Physicist. Has been working with S. N. Vernov on variations of cosmic radiation (R. 26).
51. SHTERNFELD, A. A.: Was Chairman of the Scientific Technical Committee for Cocmic Navigation of the Astronautics Section of the Central Aeroclub of the U. S. S. R. (R. 21a).
52. SHVIDKOVSKIY, Yo G.: Physicist. Has been working with B. S. Danilin on measurement of upper layers of the atmosphere with aid of sputniks (R. 26).
53. STANYUKOVICH, K. P.: Chairman of the Scientific Technical Committee for Astronomic and Physics Problems of the Astronautics Section of the Central Aeroclub of the U. S. S. R. (R. 21a).
54. TARATYNOVA, G. P. (woman): Specialist in celestial mechanics. Worked with Okhotsimskiy on calculation of orbits for artificial satellites (R. 25).
55. TUSHKOV, N.: Candidate of Physical and Mathematical Sciences. Has been working on the problem of using satellites for measuring the external magnetic field of the earth (R. 42).
56. VARVAROV, N. A.: Specialist on rockets and space flight. Chairman of Astronautics Section of the Central Aeroclub of the U. S. S. R. (R. 6, 21).
57. VAVILOV, V. S.: Physicist. Has been working on the problem of developing silicon solar batteries for use on artificial satellites (R. 25).
58. VASIL'YEV, R. R.: Member of the Institute of Automatics and Telemechanics of the U. S. S. R. Academy of Sciences. Has been engaged in work on design of robot mechanisms for exploration of the moon (R. 32).
59. VERNOV, Sergey Nikolayevich: Corresponding member of the U. S. S. R. Academy of Sciences. Cosmic ray specialist. Chairman of the Cosmic Ray Group of the IGY Committee of the Academy of Sciences of the U. S. S. R. Has worked on cosmic rays for more than 25 years. Is now working on cosmic ray problems beyond the boundaries of the atmosphere of the earth (R. 8a, 25, 26, 37a, 44b).

60. YATSUNSKIY, I. M.: Physicist. Has been working on problem of how geophysical factors affect the motion of artificial satellites (R. 25).
61. YEFREMOV, A. I.: Radiologist. Has been working on high frequency ultraviolet rays of the sun in the upper atmosphere of the earth (R. 26).
62. YEGOROV, V. A.: Mathematician. Has been working on dynamics of space flights and has worked out the trajectories and dynamics of a flight for looping the moon. Is a member of the Mathematical Institute of the U. S. S. R. Academy of Sciences (R. 25).
63. ZELIKMAN, M. Kh.: Physicist. Has been working on the problem of concentrations of positive ions in the orbit of artificial satellites of the earth (R. 26).
64. ZHELTENKOV, V.: Engineer. Proposed a new type of "solar fuel" (i. e., atomic oxygen whose reconversion into molecular state can be controlled by means of inhibitors and catalysts) which could be used as a means of propulsion in space (R. 34).

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